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HISTORIC (1971-1975)
COST-REVENUE ANALYSIS
OF THE AUTOMOTIVE OPERATIONS
OF THE MAJOR U.S. AUTOMOTIVE PRODUCTS
MANUFACTURERS

R. Kaiser

H.H. Aerospace Design Co., Inc.
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Bedford MA 01730



April 78

January 1979

FINAL REPORT

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16. Abstract <p>A cost-revenue analysis is performed for the manufacture of automotive vehicles between 1971 and 1975 for the four major U.S. automotive manufacturers: American Motors Corp., Chrysler Corp., Ford Motor Co., and General Motors Corp. The analysis used a "top-down" methodology based principally on corporate operating statements and supporting notes published in corporate annual reports and SEC 10K forms. The study entailed the disaggregation of the consolidated corporate financial data presented and the identification or estimation of data pertinent to automotive operations.</p> <p>In the study, automotive operations were examined at three levels of disaggregation:</p> <ul style="list-style-type: none">a) Worldwide automotive operationsb) North American (U.S. and Canada) automotive operationsc) U.S. manufacture of passenger vehicles and light trucks			
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PREFACE

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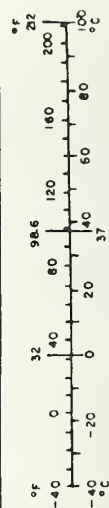
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
m ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tabsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10,000 m ²)	2.5	acres	ac
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
	liters	1.06	quarts	qt
	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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1. INTRODUCTION

The cost-revenue relationship for the manufacture of automotive vehicles by the four major U.S. automotive manufacturers, American Motors Corp. (A.M.C.), Chrysler Corp. (Chrysler), Ford Motor Company (Ford) and General Motors Corp. (GMC), was estimated for the period 1971 to 1975. The analysis used a "top-down" methodology based principally on corporate operating statements and supporting notes published in corporate annual reports and SEC 10 K forms. The study entailed the disaggregation of the consolidated corporate financial data presented in these reports, and the identification or estimation of data pertinent to automotive operations.

In the study, automotive operations were examined at three levels of disaggregation:

- a) Worldwide automotive operations
- b) North American (U.S. and Canada) automotive operations
- c) U.S. manufacture of passenger automobiles and light trucks

The organizational relationships of the operating levels considered are presented in Figure 1. The first level of disaggregation distinguishes between the automotive manufacturers' automotive operations (the manufacture and sale of automobiles, trucks and automotive parts) on a worldwide basis and their non-automotive operations (such as the manufacture of appliances, farm machinery, non-automotive glass and steel products, etc.). A second level of disaggregation distinguishes between North American (U.S. and Canada) automotive operations and foreign (worldwide less North America) operations. The third, and most detailed level of disaggregation considered is the U.S. manufacture of passenger automobiles and light trucks of less than 6000 lbs. G.V.W.

The data presented for each company, for each level of disaggregation, and for each fiscal year between 1971 and 1975 include estimates for the following:

- a) Revenue

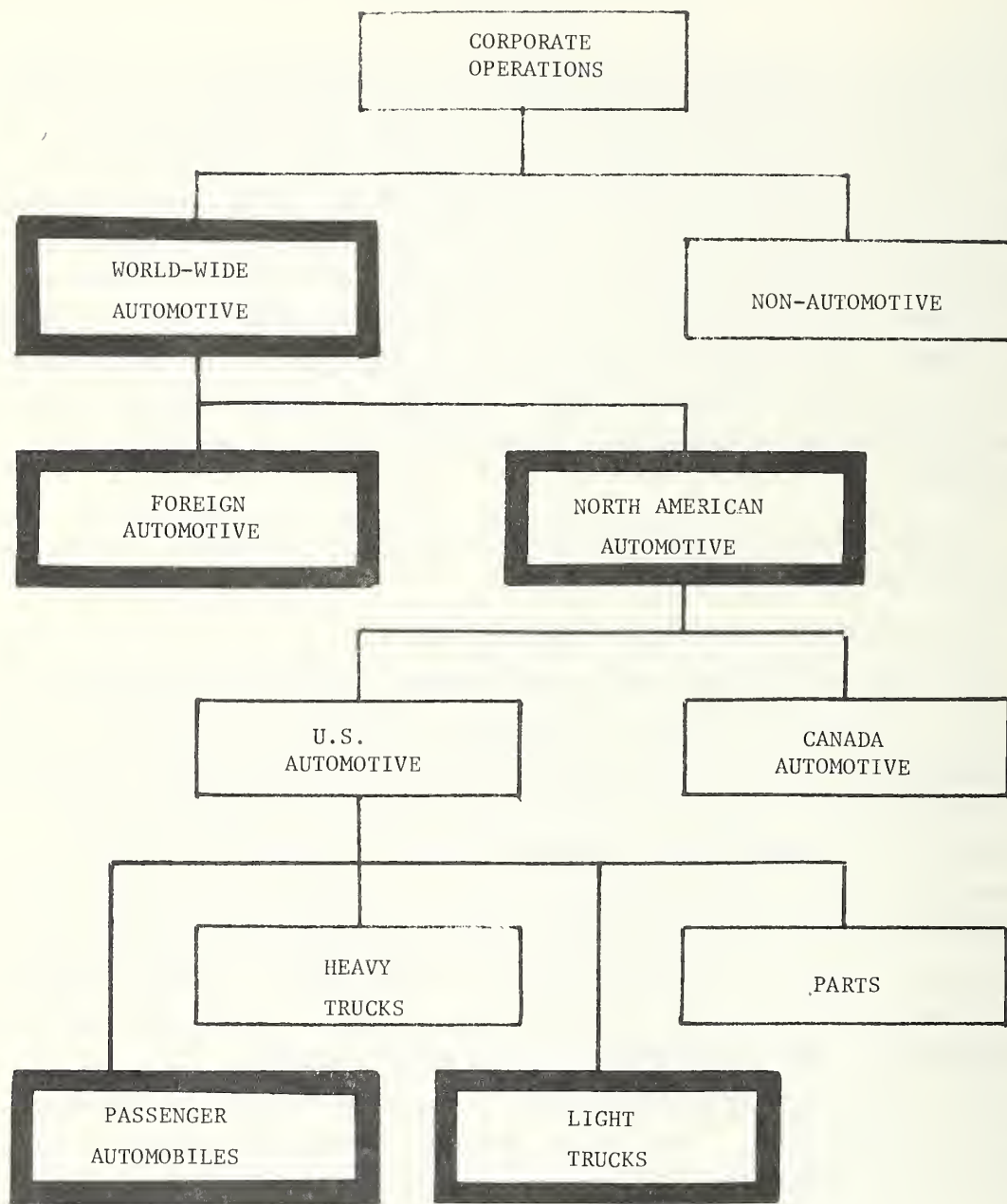


FIGURE 1. LEVELS OF DISAGGREGATION OF CORPORATE OPERATIONS OF U.S. AUTOMOTIVE MANUFACTURERS CONSIDERED IN THE PRESENT STUDY.

- b) Pretax Earnings
- c) Total Costs
- d) Fixed Costs
- e) Variable Costs
- f) Number Units Manufactured
- g) Average Unit Revenue
- h) Average Unit Variable Cost
- i) Average Unit Variable Margin
- j) Break Even Production Level.

For higher levels of disaggregation, for which explicit data were lacking in the corporate reports, it was necessary to make a number of assumptions in order to obtain some of the desired values, as explained further in the body and appendices of this report. The extent of the estimation procedure increased with the degree of disaggregation desired.

For each manufacturer and at each level of disaggregation of interest, the financial data developed were used to estimate a Break Even Sales Volume (BESV). The B.E.S.V. is defined as that volume of output of which revenue is just equal to total costs (fixed costs plus variable costs). Referring to Fig. 2, which is a simplified break even diagram, income and costs are shown on the vertical axis and the units produced and sold are shown on the horizontal axis. Total income is assumed to increase linearly with units sold; total costs increase linearly with units produced. Fixed costs remain invariant with respect to production.

The B.E.S.V. is defined mathematically as follows:

$$\text{BESV} = \frac{\text{Fixed Costs}}{\text{Unit Sales Price} - \text{Unit Variable Cost}}$$

or

$$\text{BESV} = \frac{\text{Fixed Costs}}{\text{Variable Margin}}$$

The profit is given by

$$\text{Profit} = (\text{Sales} - \text{Break Even Sales}) \times \text{Variable Margin}$$

Income and costs

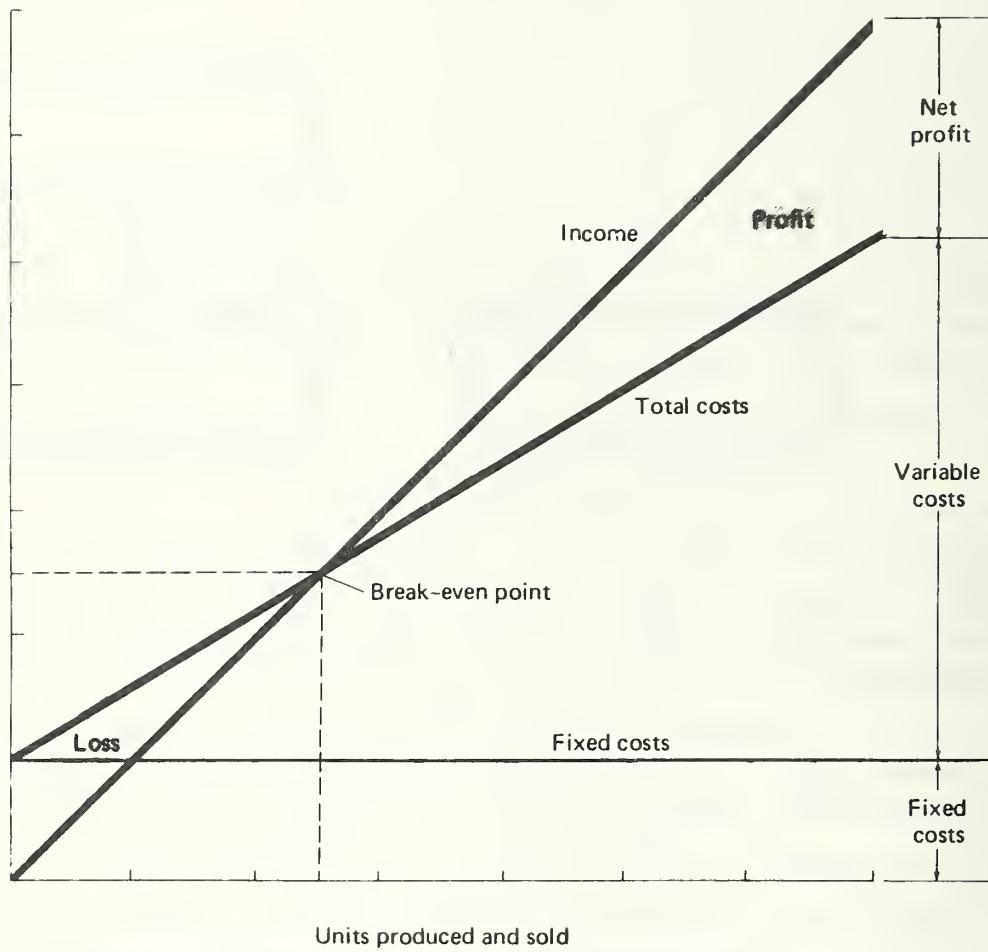


FIGURE 2. BREAK EVEN ANALYSIS

For a fixed sales volume, the profit can be increased by increasing the variable margin through increase in sales price or decrease in variable costs, thus decreasing the break even sales point. Alternatively, profit can be increased by increasing the sales volume. The converse is true in both cases.

Even a simplified break even analysis as above illustrates clearly the impact of short term sales fluctuations on a high sales/capital leverage industry such as auto manufacturing. The break even production volume is useful as an analytical tool because it indicates the relationship between variable and fixed costs. It is a useful method of comparing a company's operations over a period of years, especially in an inflationary period. Significant variations in the BESV are indicative of major changes in a company's cost of price structure.

2. WORLDWIDE AUTOMOTIVE OPERATIONS

2.1 DISAGGREGATION OF DATA ON WORLDWIDE AUTOMOTIVE OPERATIONS

Corporate operating statements present consolidated data which include corporate revenue, corporate pretax earnings and corporate costs. The revenue and profits generated by the major business lines of a corporation are also identified in the SEC 10 K reports. Thus, the four major U.S. automotive manufacturers distinguish between their automotive operations and their non-automotive operations. It is important to note that for all four manufacturers, automotive operations generate over 90 percent of the sales revenue and profits of the corporation.

Ford and Chrysler treat their international automotive operations on a consolidated basis. GMC presents gross data for U.S., Canadian and overseas automotive operations. These gross figures include intracompany sales, which have to be eliminated to avoid double-counting. It is assumed that intracompany sales were limited to automotive operations, so that the net sales and pretax profits of GMC's automotive operations are equal to the differences between net corporate sales and pretax profits and sales and pretax profits of non-automotive operations and defense operations, as published in the SEC 10 K reports filed by GMC. This is the same approach to the problem used by De Lorean in a recent DOT sponsored study.⁽¹⁾ De Lorean, by virtue of being a former vice-president of GMC should be familiar with the Corporation's overall financial operations. AMC presents data on the general automotive operations, special government vehicle operations (AM General Corp.), and the non-automotive operations. AMC's overall automotive operations were considered to consist of the combination of the first two operations.

(1) M.R. Hervey and D.J. Chutinsky, "Development of a Motor Vehicle Materials Historical High-Volume Industrial Processing Rates Cost Data Bank - Chevelle Report", Contract DOT-HS-5-01081, February 1976.

2.2 DISAGGREGATION OF COSTS OF WORLDWIDE AUTOMOTIVE OPERATIONS

For each of the four manufacturers the total costs of their automotive operations are obtained from the above as the difference between automotive sales and automotive pretax profits. The total costs are considered to consist of variable costs which are proportional to the number of automobiles produced and of fixed costs which are independent of the production volume.

In the corporate operating statements, consolidated corporate costs usually break down as follows:

- a) Costs, exclusive of items identified below
- b) Selling and general administrative expenses
- c) Depreciation of Real Estate Plant and Equipment
- d) Amortization of Special Tools
- e) Interest Expense
- f) Pension Contributions
- g) Provision for Incentive Programs

Further details of the general costs category (a) required by the SEC are found in the SEC 10K reports as notes supporting the operating statements. In these notes, the following costs are further explicitly identified, provided that they exceed 1 percent of corporate sales.

- h) Costs of Rearrangement, maintenance and repairs
- i) Taxes (other than United States, foreign and other income taxes)
- j) Research and Development Expenses
- k) Advertising Expenses

For the purpose of this analysis, corporate fixed costs are considered to be the sum of cost categories (b) through (k) explicitly identified in the corporate operating statements and supporting notes. In some years, advertising costs were less than 1 percent of corporate sales for GMC and Chrysler, and are thus not specifically identified. For those years, advertising costs are assumed to be 0.9 percent of corporate sales. Comparable sets of fixed costs are then presented for all four manufacturers. Any error

introduced is deemed small.

Since automotive operations dominate the operations of all four companies, it is quite likely that corporate fixed costs are mainly associated with automotive operations. It is therefore assumed that the fixed costs of automotive operations are equal to the corporate fixed costs, as defined above. This assumption which neglects fixed costs associated with non-automotive operations tends to exaggerate the fixed costs by a small amount. In all cases, the error is less than 10 percent.

Variable costs of automotive operations are then obtained as the difference between total costs of automotive operations and fixed automotive (corporate) costs. Since variable costs represent the majority of total costs (about 80 percent or greater), the proportionate error in the variable cost estimate is significantly smaller than any error in the fixed cost estimate.

2.3 AUTOMOTIVE UNIT SALES

The four major manufacturers also publish in their annual reports data on their unit factory sales of automotive vehicles during the fiscal year by type of vehicle and geographical location of manufacture. The sole exemption is the number of vehicles produced by the AM general subsidiary of AMC during the AMC fiscal year. These production figures can be estimated from data on AM general's production on a calendar year basis that are published annual trade reports (such as Ward's Automotive Year Book or the Automotive News Annual Yearbook).

An estimate of the average revenue per vehicle obtained by the manufacturer, or average vehicle price, is obtained by dividing automotive sales during a fiscal year by the number of automotive vehicles produced by the corporation during the fiscal year. Similarly, an estimate of the average unit variable costs is obtained by dividing the estimated variable costs of automotive operations by the automotive vehicles produced. The variable margin per unit is then obtained by subtracting the average variable unit cost from the average vehicle price.

It is to be pointed out that the unit revenue and cost values thus obtained include the contribution of automotive parts to overall automotive costs and revenues. Since these contributions are not factored out, the actual average unit vehicle revenue and costs are lower than the estimates presented here. As discussed subsequently in the cost revenue analysis of U.S. automotive and light truck manufacturers, discounting the manufacture of automotive parts results in estimates of unit revenue and costs that are influenced by approximately 5 to 10 percent.

2.4 DATA — WORLDWIDE AUTOMOTIVE OPERATIONS

Financial data on the worldwide automotive operations of the four major U.S. automotive manufacturers are summarized in the following tables:

American Motors Corp.	Tables 1 and 2
Chrysler Corp.	Tables 3 and 4
Ford Motor Co.	Tables 5 and 6
General Motors Corp.	Tables 7 and 8

Intercompany comparisons are presented on Table 9.

TABLE 1. HISTORIC COST-REVENUE DATA: AMERICAN MOTORS CORP.

	1971	1972	1973	1974	1975
Corporate					
Sales (\$10 ⁶)	1240.4	1413.0	1756.9	2023.1	2299.4
Pretax Earnings (\$10 ⁶)	11.2	31.6	75.6	41.9	(33.5)
Total Costs (\$10 ⁶)	1229.2	1381.4	1681.3	1981.2	2334.9
Overhead & Fixed Costs (\$10 ⁶)	279.8	319.6	381.2	405.5	446.4
Automotive Operations					
Unit Sales,*W.W.(10 ³)	378 .	437.	552.	585.	524.
Sales (\$10 ⁶)	1235.3	1406.0	1735.4	1977.0	2248.8
Pretax Earnings (\$10 ⁶)	10.5	30.7	72.3	36.6	(37.1)
Total Costs (\$10 ⁶)	1224.8	1375.3	1663.1	1940.4	2285.9
Fixed Costs (\$10 ⁶)	279.8	319.6	381.2	405.5	446.4
Variable Costs (\$10 ⁶)	945.0	1055.7	1281.9	1534.9	1839.5
Cost Revenue per Automotive Unit**					
Revenue (\$)	3300.	3200.	3100.	3400.	4300.
Variable Cost (\$)	2500.	2800.	2800.	2800.	3800.
Variable Profit (\$)	800.	400.	300.	600.	500.
Break Even Production (10 ³ units)	360.	400.	460.	540.	580.
Unit Sales (10 ³ units)					
U.S. Automotive (Fiscal Year)	287.	342.	447.	449.	389.
Canada & WW Automotive (Fiscal Year)	58.	59.	67.	96.	106.
AM General (Calendar Year)	33.	35.	58.	40.	29.

*Automobiles and Trucks

**Unit - Average Automobile/Truck not corrected for automotive parts

TABLE 2. CORPORATE FIXED COSTS: AMERICAN MOTORS CORP.

Year	1971	1972	1973	1974	1975
Cost Category	Millions of Dollars				
Selling and General Administrative Expenses	125.0	137.3	164.6	174.1	187.4
Depreciation of Real Estate, Plant and Equipment	13.8	14.2	13.8	15.9	19.3
Amortization of Special Tools	22.4	23.3	20.6	23.8	35.2
Interest Expense	5.6	6.4	6.6	6.8	15.9
Pension Contributions	16.4	17.7	20.9	24.8	28.7
Provisions for Incentive Programs	-	-	-	-	-
Cost of Rearrangements, Maintenance and Repairs	23.0	29.3	40.7	43.7	43.9
Taxes (other than U.S. and Foreign Income Taxes)	21.6	24.4	37.2	35.2	35.2
Research and Development Expenses	25.0(est)	32.9	38.2	38.1	36.5
Advertising Expense	27.0(est)	34.1	38.6	43.1	44.3
Total Fixed Cost	279.8	319.6	381.2	405.5	446.4

TABLE 3. HISTORIC COST-REVENUE DATA: CHRYSLER CORP.

	1971	1972	1973	1974	1975
Corporate					
Sales (\$10 ⁶)	7892.6	9640.7	11667.4	10860.0	11598.4
Pretax Earnings (\$10 ⁶)	157.0	418.4	468.5	(119.8)	(180.4)
Total Costs (\$10 ⁶)	7735.6	9223.3	11198.9	10979.8	11778.8
Overhead + Fixed Costs (\$10 ⁶)	1857.3	1774.5	2040.0	2059.0	2043.5
Automotive Operations					
Unit Sales*, W.W. (10 ³)	2663.	3028.	3402.	2763.	2476.
Sales (\$10 ⁶) (a)	7498.	9159.	11084.	10317.	11018.
Pretax Earnings(a)(\$10 ⁶)	149.	398.	445.	(114)	(172.)
Total Costs (a)(\$10 ⁶)	7349.	8761.	10639.	10431.	11190.
Fixed Costs (\$10 ⁶)	1857.	1775.	2040.	2059.	2044.
Variable Costs (\$10 ⁶)	5492.	7024.	8559.	8372.	9146.
Cost Revenue per Automotive Unit**					
Revenue (\$)	2800.	3000.	3200.	3700.	4570.
Variable Cost (\$)	2100.	2300.	2500.	3000.	3700.
Variable Profit (\$)	700.	700.	700.	700.	800.
Break Even Production (10 ³ units)					
	2500.	2500.	2800.	2900.	2700.

(a) 95% of corp. values

*Automobiles and Trucks

**Unit = Average Automobile/Truck not corrected for automotive parts

TABLE 4. CORPORATE FIXED COSTS: CHRYSLER CORP.

Year	1971	1972	1973	1974	1975
Cost Category	Millions of Dollars				
Selling and General Administrative Expense	370.1	415.5	466.5	485.5	465.8
Depreciation of Real Estate, Plant and Equipment	173.7	170.9	178.0	181.9	123.6
Amortization of Special Tools	183.0	194.9	192.7	138.9	170.8
Interest Expense	70.6	56.5	32.5	107.8	168.3
Pension Contributions	148.9	176.5	198.7	254.2	281.0
Provisions for Incentive Programs	-	14.7	17.6	-	-
Cost of Rearrangements, Maintenance and Repairs	247.0	307.0	403.0	337.9	302.0
Taxes (other than U.S. and Foreign Income Taxes)	450.0	166.5	201.0	202.7	213.8
Research and Development	143.0	185.0	245.0	238.8	199.0
Advertising Expense	71.0*	87.0*	105.0*	111.3	119.2
Total Fixed Costs	1857.3	1774.5	2040.0	2059.0	2043.5

*Assumed to be 0.9% corporate sales

TABLE 5. HISTORIC COST-REVENUE DATA: FORD MOTOR CO.

	1971	1972	1973	1974	1975
Corporate					
Sales (\$10 ⁶)	16443.0	20194.1	23015.1	23020.6	24009.1
Pretax Earnings (\$10 ⁶)	1292.4	1662.6	1632.7	587.4	398.2
Total Costs (\$10 ⁶)	15150.6	18531.5	21382.4	23033.2	23610.9
Overhead Fixed Costs (\$10 ⁶)	3579.0	4237.8	4670.4	4797.9	4786.3
Automotive Operations					
Unit Sales,*W.W.(10 ³)	4933.	5593.	5871.	5259.	4578.
Sales (\$10 ⁶)	14998.	18516.	21041.	21528.	21688.
Pretax Earnings (\$10 ⁶)	1220.	1576.	1509.	482.	296.
Total Costs (\$10 ⁶)	13778.	16940.	19532.	21046.	21392.
Fixed Costs (\$10 ⁶)	3579.	4238.	4670.	4798.	4786.
Variable Costs (\$10 ⁶)	10199.	12702.	14862.	16248.	16606.
Cost Revenue per Automotive Unit**					
Revenue (\$)	3000.	3300.	3600.	4100.	4700.
Variable Costs (\$)	2100.	2300.	2500.	3100.	3600.
Variable Margin (\$)	900.	1000.	1100.	1000.	1100.
Break Even Production (10 ³ units)	3700.	4100.	4400.	4700.	4300.
Factory Sales					
U.S. & Canada	3351	3848	4102	3730	3033
Outside U.S. & Canada	1582.	1745	1769	1529	1545

*Automobiles and Trucks

**Unit = Average Automobile/Truck not corrected for automotive parts

TABLE 6. CORPORATE FIXED COSTS: FORD MOTOR CO.

Year	1971	1972	1973	1974	1975
Cost Category	Millions of Dollars				
Selling and General Administrative Expense	879.3	1006.9	1047.4	1032.0	1036.7
Depreciation of Real Estate, Plant and Equipment	427.1	455.0	485.1	530.8	583.8
Amortization of Special Tools	396.8	458.3	463.1	392.7	435.3
Interest Expense	12.5	16.2	(30.4)	82.9	123.9
Pension Contributions	239.2	312.1	355.9	385.3	426.7
Provisions for Incentive Programs	44.0	64.0	60.5	-	-
Cost of Rearrangements, Maintenance and Repairs	495.8	615.6	702.0	734.8	664.4
Taxes (other than U.S, and Foreign Income Taxes)	369.5	451.8	546.3	601.0	645.6
Research and Development Expense	509.0	621.1	826.0	829.9	747.6
Advertising Expense	206.1	236.8	234.5	213.5	222.3
Total Fixed Costs	3579.0	4237.8	4670.4	4797.9	4786.3

TABLE 7. HISTORIC COST-REVENUE DATA: GENERAL MOTORS CORP.

	1971	1972	1973	1974	1975
Corporate					
Sales (\$10 ⁶)	28263.9	30435.2	35798.3	31549.5	35724.9
Pretax Earnings (\$10 ⁶)	3719.8	4222.6	4513.1	1677.2	2371.3
Total Costs (\$10 ⁶)	24544.1	26212.6	31285.2	29872.3	33353.6
Overhead & Fixed Costs (\$10 ⁶)	7119.0	7397.7	8673.4	8342.0	8924.1
Automotive Operations					
Unit Sales, *W.W. (10 ³)	7779.	7791.	8684.	6690.	6629.
Sales (\$10 ⁶)	26288.	28408.	33543.	28980.	32944.
Pretax Earnings (\$10 ⁶)	3682.	4096.	4423.	1543.	2182.
Total Costs (\$10 ⁶)	22606.	24312.	29120.	27437.	30763.
Fixed Costs (\$10 ⁶)	7119.	7398.	8673.	8342.	8924.
Variable Costs (\$10 ⁶)	15487.	16914.	20447.	19095.	21739.
Cost Revenue per Automotive Unit**					
Revenue (\$)	3400.	3700.	3800.	4300.	5000.
Variable Cost (\$)	2000.	2200.	2300.	2800.	3300.
Variable Margin (\$)	1400.	1500.	1500.	1500.	1700.
Break Even Production (10 ³ units)	5600.	5000.	5800.	5600.	5300.

*Automobiles and Trucks

**Unit = Average Automobile/Truck not corrected for automotive parts

TABLE 8. CORPORATE FIXED COSTS: GENERAL MOTORS CORP.

Year	1971	1972	1973	1974	1975
Cost Category	Millions of Dollars				
Selling and General Administrative Expense	1188.6	1162.5	1328.1	1363.9	1333.7
Depreciation of Real Estate, Plant and Equipment	873.1	912.4	902.9	846.6	906.1
Amortization of Special Tools	917.5	874.2	1081.0	858.4	1180.1
Interest Expense	36.4	(71.1)	(150.7)	(6.7)	147.7
Pension Contributions	500(est)	530.0	718.7	818.6	969.1
Provisions for Incentive Programs	90.0	101.4	112.8	5.9	32.9
Cost of Rearrangements, Maintenance and Repairs	1479.1	1632.2	2026.1	1854.5	1701.4
Taxes (other than U.S. and Foreign Income Taxes)	775.9	917.9	1090.7	1142.0	1217.7
Research and Development Expense	1004.1	1064.3	1241.6	1125.4	1113.9
Advertising Expense	254.3*	273.9*	322.2*	333.4	321.5*
Total Fixed Costs	7119.0	7397.7	8673.4	8342.0	8924.1

*Assumed to be 0.9% Corporate Sales

TABLE 9. ESTIMATED VARIABLE AND FIXED COSTS CHARACTERISTICS FOR THE WORLDWIDE AUTOMOTIVE OPERATIONS (PASSENGER AND NON-PASSENGER AUTOS) OF THE DOMESTIC AUTO MANUFACTURERS.

YEAR	1971	1972	1973	1974	1975
Manufacturer	WORLD WIDE UNIT SALES, (10 ³ VEHICLES/YEAR)				
AMC	378	437	552	585	524
Chrysler	2476	2763	3402	3028	2663
Ford	4933	5593	5871	5259	4578
GMC	7779	7791	8684	6690	6629
	AVERAGE REVENUE PER UNIT, DOLLARS				
AMC	3300	3200	3100	3400	4300
Chrysler	2800	3000	3200	3700	4500
Ford	3000	3300	3600	4100	4700
GMC	3400	3700	3800	4300	5000
	AVERAGE VARIABLE COSTS PER UNIT, DOLLARS				
AMC	2500	2400	2300	2600	3500
Chrysler	2100	2300	2500	3000	3700
Ford	2100	2300	2500	3100	3600
GMC	2000	2200	2300	2800	3300
	AVERAGE VARIABLE MARGIN, DOLLARS				
AMC	800	800	800	800	800
Chrysler	700	700	700	700	800
Ford	900	1000	1000	1000	1100
GMC	1400	1500	1500	1500	1700
	CORPORATE FIXED COSTS (MILLION DOLLARS)				
AMC	280	320	381	406	446
Chrysler	1857	1775	2040	2059	2044
Ford	3579	4238	4670	4798	4786
GMC	7119	7398	8673	8342	8924
	BREAK EVEN PRODUCTION (10 ³ VEHICLES/YEAR)				
AMC	360	400	460	540	580
Chrysler	2500	2500	2800	2900	2700
Ford	3700	4100	4400	4700	4300
GMC	5600	5000	5800	5600	5300

3. COST-REVENUE ANALYSIS OF NORTH AMERICAN AUTOMOTIVE OPERATIONS (AND FOREIGN AUTOMOTIVE OPERATIONS)

3.1 INTRODUCTION

The general method used in the previous section to develop data on the domestic manufacturers worldwide automotive operations is also used to develop data on the North American and Foreign automotive operations of GMC, Ford and Chrysler. Since AMC is principally a North American Company, the worldwide analysis applies to this manufacturer's North American operations. For purposes of automotive manufacturing, the qualifying term "North American" applies specifically to the United States and Canada, and does not include Mexico which is part of the manufacturer's "foreign operations." North American production facilities are geared to satisfying the needs of an integrated North American Market which has very different requirements in terms of consumer preference and demands for automotive vehicles than the foreign market. The Canadian manufacturing facilities of any of the major U.S. automotive manufacturing companies are an integral part of the production network, as are the manufacturers' U.S. production facilities, and are geared to supplying automotive vehicles for the North American Market. For example, most of the 350 CID and 400 CID V-8 engines assembled by Ford in Windsor, Ontario, are used in vehicles assembled in the United States. The short blocks and pistons that go into these engines are made in the United States. Another example is that Chrysler's only assembly plant for the Cordoba, which is widely sold in the United States, is in Canada.

The North American Segment of the companies automotive companies' operations is obviously the segment of their operations most seriously impacted by the need to satisfy any proposed U.S. AFER regulations.

3.2 METHODOLOGY

The major automotive manufacturers are required to report foreign sales and earnings in their annual SEC 10K reports. It proved most practical to first develop the data needed to perform a cost-revenue analysis of a manufacturer's foreign automotive operations, as outlined in Table 10. North American operations are then treated as the difference between Worldwide Operations, as developed in the previous section, and foreign automotive operations. The methodology used for North American Automotive Operations is outlined in Table 11.

TABLE 10. METHODOLOGY - COST-REVENUE ANALYSIS
OF FOREIGN AUTOMOTIVE OPERATIONS

1. Identify Foreign Automotive Unit Sales.
2. Identify Foreign Sales.
3. Identify Foreign After Tax Profits.
4. Identify Foreign Taxes and Convert Foreign After Tax Profits into Foreign Pretax Profits.
5. Obtain Total Costs of Foreign (Automotive) Operations as the Difference Between Sales and Foreign Pretax Profits.
6. Estimate Foreign Fixed Costs by Multiplying Corporated Fixed Costs by a Reasonable Weighing Factor Derived from Different Financial Ratios.
7. Obtain estimate of Foreign Variable Costs as Difference between Foreign Total Costs and Estimate of Foreign Fixed Costs.
8. Obtain Average Revenue/Unit (Foreign) by Dividing Foreign Sales by Foreign Automotive Unit Production.
9. Obtain Average Variable Cost/Unit (Foreign) by Dividing Estimate of Foreign Variable Costs by Foreign Automotive Unit Production.
10. Obtain Variable Margin/Unit (Foreign) as the Difference of the Above Two Terms.
11. Calculate BESV for Foreign Automotive Operations by Dividing the Estimated Foreign Fixed Costs by the Variable Margin/Unit (foreign).

TABLE 11. METHODOLOGY - COST-REVENUE ANALYSIS OF
NORTH AMERICAN AUTOMOTIVE OPERATIONS

1. Identify North American Automotive Unit Sales.
2. Identify North American Automotive Sales or Calculate as Difference Between World Wide Automotive Sales and Foreign Automotive Sales.
3. Identify North American Automotive Pretax Profits, or Calculate as Difference Between World Wide Automotive Pretax Profits and Foreign Automotive Pretax Profits.
4. Calculate North American Automotive Total Costs as Difference Between North American Automotive Sales and North American Automotive Pretax Profits.
5. Obtain estimate of North American Automotive Fixed Costs as Difference Between Corporate Fixed Costs and Estimate of Foreign Fixed Costs.
6. Obtain Estimate of North American Automotive Variable Costs as Difference between North American Total Costs and Estimate of North American Fixed Costs.
7. Obtain Average Revenue/Unit (North American) by dividing North American Automotive Sales by North American Automotive Unit Sales.
8. Obtain Average Variable Cost/Unit (North American) by Dividing Estimate of North American Automotive Variable Costs by North American Automotive Unit Sales.
9. Obtain Variable Margin/Unit (North American) as the Difference of the Above Two Terms.
10. Calculate BESV for North American Automotive Operations by Dividing Estimated Foreign Fixed Costs by the Variable Margin/Unit (North American).

The manufacturers all report factory unit sales of automotive vehicles on a geographical basis. The annual reports draw attention to the number of vehicles they produced in North America as well as overseas.

Sales and pretax profits of North American automotive operations are either given explicitly in the financial reports (as in the case of GMC), or can be estimated as the difference between the sales and profits of worldwide automotive operations and foreign operations. This neglects the relatively minor contribution of non-automotive operations to foreign sales and profits. Foreign profits, which are normally reported as after tax profits, have to be adjusted by the addition of foreign tax payments to reflect equivalent pretax profits.

The major problem in performing a financial analysis of a particular operation of a major multi-national company is that of disaggregating costs. The companies do not report on their internal cost structure, nor on the allocation of resources to specific segments of their operation. The breakdown of total costs into fixed and variable components for North American and foreign operations are a "best efforts" estimate based on very limited data and presumptions as to what would be a rational allocation of resources by the manufacturers.

GMC publishes significantly more financial data about its foreign operations than do either Ford or Chrysler. In the case of GMC, the availability of the data makes it possible to estimate fixed costs for foreign operations in a number of different ways and to evaluate the variations of the calculated values of fixed costs obtained by different estimating procedures. As further discussed below, it appears that multiplying corporate fixed costs by the ratio of average foreign sales to total corporate sales over a five year period results in an estimate of foreign fixed costs which is not significantly different from values of foreign fixed costs obtained by other estimating techniques. In all cases the total range of the various estimates is less than 10 percent. The estimate obtained by using the average five year sales percentage as an allocating characteristic is a better representation of the

mean of the range of estimates than some of the other estimates obtained. Since this estimating technique requires only sales data, it could be used with all companies and thus allows a standardized estimating procedure to be applied to all companies.

Various methods of estimating the fixed costs of GMC's foreign operations are outlined in the next section. Financial data of interest on the foreign operations and the North American automotive operations of GMC, Ford and Chrysler are then presented.

Once estimates of foreign fixed costs are obtained, estimates of the fixed costs of North American Operations are derived as the difference between corporate fixed costs and the estimate of foreign fixed costs. The various estimates of North American fixed costs are also presented in Table 12.

Except for the fixed cost estimate calculated on the basis of the ratio of net property, the various fixed cost estimates agree to within \$300 million. For foreign operations, this represents a variation of about 20 percent, but only 5 percent for North American operations.

3.3 ESTIMATION OF FIXED COSTS OF GMC FOREIGN AND NORTH AMERICAN OPERATIONS

In addition to foreign sales and profits, GMC also publishes in its SEC 10K annual report, the following financial data for its foreign operations: Total Assets, Net Assets, Plant Property and Equipment of cost, Accumulated Depreciation, Net Plant Property and Equipment, Special Tools (less amortization), and Total Property. It also publishes information on its foreign real estate holdings in terms of the square footage of property owned or leased. The data are given in Table 13 as a percentage of corporate values.

The above data are used to obtain a number of estimates of foreign fixed costs of the Corporations, which are listed in Table 12.

1. Estimate 1: Over the long term, a corporation will allocate its resources so as to maximize its sales and profits. A first estimate of fixed costs for foreign operations is obtained by multiplying corporate fixed costs by the ratio of foreign sales to

TABLE 12. DISAGGREGATION OF FIXED COSTS FOR GMC

	1975	1974	1973	1972	1971
<u>Estimated Foreign Fixed Costs</u>					
Estimate #1 (Corp. Fixed Costs)(5 Yr. Avg. Sales Factor = .12)	1535.	1435.	1492.	1272.	1275.
Estimate #2					
Foreign Amortization: (Amort. WW)(2% Foreign Special Tools)	447.3	311.6	468.1		
Foreign Depreciation: (Dep WW)(2% Foreign Net Profit)	153.1	141.4	145.4		
Taxes Other than Intome = (Taxes WW) (%Foreign Sq. Ft.	241.7	236.7	223.6		
Other Fixed Cost: (Other Fixed Cost WW) (% Foreign Sales 5 Yr. Avg.)	996.7	945.1	963.0		
Total	1809.	1637.	1800.		
Estimated #3 (Corp.Fixed Costs)(% Net Assets)	1035.	834.	876.	673.	626.
Estimated #4 (Corp.Fixed Costs)(% Total Assets)	1740.	1744.	1544.	1221.	1039.1
Estimated #5 (Corp.Fixed Costs)(% Total Prop- erty)	1633.	1535.	1613.	1287.	1232.1
Estimated North Ameri- can Fixed Costs: WW Fixed - Foreign Fixed Estimate					
Based on Estimate 1	7389.	6907.	7181.	6125.	5895.
" 2	7115.	6705.	6873.		
" 3	7889.	7508.	7197.	6725.	6493.
" 4	7184.	6598.	7129.	6177.	6080.
" 5	7291.	6807.	7060.	6110.	5887.
Best Guess North Am. "Fixed Costs" Range	7100-7400	6600-6900	6900-7200	6100-6300	5800-6100

TABLE 13. FOREIGN PERCENTAGES OF VARIOUS FINANCIAL INDICATORS FOR GMC

	1971	1972	1973	1974	1975
Foreign Operations as Percent Corporate Operations					
Sales (5 yr average = 17.2%)	14.5	15.6	16.1	18.9	20.2
Total Assets	14.6	16.5	17.8	20.9	19.5
Net Assets	8.8	9.1	10.1	10.0	11.6
Plant, Property and Equipment, @ Cost			16.6	16.5	16.6
Accumulated Depreciation			16.8	16.7	16.9
Net Plant, Property and Equipment			16.1	16.1	16.2
Special Tools (less Amortization)			43.3	36.3	37.9
Total Property	17.3	17.4	18.6	18.4	18.3
Real Estate (Area Basis)			20.5	21.5	20.7

corporate sales averaged over a five year period to eliminate short term sales fluctuations. For the period 1971 to 1975, foreign operations accounted for 17.2 percent of GMC's sales. The first estimate of GMC's foreign fixed costs in a given year is therefore 0.172 times corporate fixed costs for that same year.

2. Estimate 2: The second estimate is a variation of the first estimate in which an attempt is made to obtain a more direct estimate of specific components of fixed costs for which additional data exist. In this estimate it is assumed that:

a) Foreign Amortization is equal to corporate amortization times the ratio of value of special tools (less amortization) for foreign operations to the value of special tools (less amortization) on a corporate basis.

b) Foreign depreciation is equal to Corporate depreciation times the ratio of Net Property Plant and Equipment for foreign operations to Corporate net property plant and equipment.

c) Foreign taxes other than income taxes are assumed to be equal to corporate payment for taxes other than income taxes times the ratio of the area of foreign realty holdings to the area of corporate realty holdings.

d) All other foreign fixed costs are assumed to be equal to the value of all other corporated fixed costs times 0.172 (e.g., sales weighing) as discussed above. These other fixed costs are calculated in this manner for lack of other substantiating data.

3. Estimate 3: A third estimate of foreign fixed costs is obtained by assuming that fixed costs are proportional to net assets. In this case, foreign fixed costs in a given year are equal to Corporate fixed costs times the ratio of foreign net assets to corporate net assets (e.g., stockholder equity).

4. Estimate 4: A fourth estimate of foreign fixed costs is obtained by assuming that fixed costs are proportional to total assets. In this instance, foreign fixed costs in a given year are equal to corporate fixed costs times the ratio of foreign total assets to corporate total assets.

3.4 DATA

Financial data on the foreign and North American automotive operations of the three major U.S. automotive manufacturers with significant foreign operations are summarized in the following tables:

Chrysler Corp.	Table 14
Ford Motor Co.	Table 15
General Motors Corp.	Table 16

Intercompany comparisons are presented in Table 17 for foreign operations and in Table 18 for North American automotive operations. The values for AMC in Table 18 are the same as those presented in Table 9.

TABLE 14. HISTORIC COST-REVENUE DATA FOR FOREIGN AND NORTH AMERICAN AUTOMOTIVE OPERATIONS: CHRYSLER CORP.

	1971	1972	1973	1974	1975
Foreign Sales (\$10 ⁶)	1900.	2500.	3467.1	3398.3	4020.
After Tax Profits (\$10 ⁶)	5.	29.6	121.0	(7.5)	(46.7)
Foreign Income Taxes (\$10 ⁶)	52.	71.	73.5	12.2	40.1
Foreign Pretax Profit (\$10 ⁶)	57.	101.	194.5	4.7	(6.6)
Foreign Total Costs (\$10 ⁶)	1843.	2400.	3272.6	3394.	4027.
Estimated Foreign Fixed Costs (\$10 ⁶)	550.	520.	601.	646.	614.
Estimated Foreign Variable Costs (\$10 ⁶)	1293.	1880.	2671.	2748.	3413.
Foreign Automotive Units (Thousands)	870	1025	1203	993	912
Revenue/Unit, Foreign (\$)	2184	2439	2882	3422	4408
Variable Cost/Unit, Foreign,(\$)	1486	1834	2221	2767	3742
Variable Margin/Unit, Foreign(\$)	698	605	661	655	666
BESV Foreign (Thousands)	788	859	910	986	923
North American Automotive Sales (\$10 ⁶)	5598	6659	7617	6907	6998
NAA Profits, Pretax (\$10 ⁶)	92	297	251	(119)	(165)
NAA Total Costs (\$10 ⁶)	5506	6362	7366	7026	7163
NAA Estimated Fixed Costs (\$10 ⁶)	1309	1236	1430	1411	1460
NAA Estimated Variable Costs (\$10 ⁶)	4197	5126	5936	5615	5703
NAA Units (Thousands)	1793	2003	2199	1769	1564
Revenue/Unit, NAA (\$)	3122	3325	3464	3904	4474
Variable Cost/Unit, NAA (\$)	2341	2559	2699	3174	3646
Variable Margin/Unit, NAA (\$)	781	766	765	730	828
BESV NAA (Thousand Units)	1676	1614	1870	1932	1763

TABLE 15. HISTORIC COST-REVENUE DATA FOR FOREIGN AND NORTH AMERICAN AUTOMOTIVE OPERATIONS: FORD MOTOR CO.

	1971	1972	1973	1974	1975
Foreign Sales (\$10 ⁶)	4073	5099	5925	6523	7880
After Tax Profits (\$10 ⁶)	25	147	217	71	161
Foreign Income Taxes (\$10 ⁶)	147	228	317	159	241
Foreign Pretax Profit (\$10 ⁶)	172	375	534	230	402
Foreign Total Costs (\$10 ⁶)	3901	4724	5391	6293	7478
Estimated Foreign Fixed Costs (\$10 ⁶)	977	1149	1271	1303	1314
Estimated Foreign Variable Costs (\$10 ⁶)	2925	3575	4120	4989	6164
Foreign Automotive Units (Thousands)	1582	1745	1769	1529	1545
Revenue/Unit, Foreign, (\$)	2575	2922	3349	4266	5100
Variable Cost/Unit, Foreign (\$)	1849	2049	2329	3263	3990
Variable Margin/Unit, (Foreign) (\$)	726	873	1020	1003	1110
BESV Foreign (Thousands)	1345	1315	1246	1300	1184
North American Automotive Sales (\$10 ⁶)	10925	13417	14518	15005	13808
NAA Profits, Pretax (\$10 ⁶)	1048	1201	975	252	(106)
NAA Total Costs (\$10 ⁶)	9877	12216	13543	14753	13914
NAA Estimated Fixed Costs (10 ⁶)	2575	3028	3351	3436	3465
NAA Estimated Variable Costs (\$10 ⁶)	7302	9188	10192	11317	10449
NAA Units (Thousands)	3351	3848	4102	3730	3033
Revenue/Unit, NAA, (\$)	3260	3487	3539	4023	4553
Variable Cost/Unit, NAA(\$)	2179	2388	2485	3034	3445
Variable Margin/Unit, NAA (\$)	1081	1099	1054	989	1108
BESV NAA (Thousand Units)	2381	2755	3179	3474	3128

TABLE 16. HISTORIC COST-REVENUE DATA FOR FOREIGN AND NORTH AMERICAN AUTOMOTIVE OPERATIONS: GENERAL MOTORS CORP.

	1971	1972	1973	1974	1975
Foreign Sales (\$10 ⁶)	4112.3	4741.5	5779.0	5968.8	7227.3
After Tax Profits (\$10 ⁶)	102.7	168.6	215.6	(0.4)	72.4
Foreign Income Taxes (\$10 ⁶)	367.1	303.7	255.0	109.1	178.9
Foreign Pretax Profit (\$10 ⁶)	469.8	472.3	470.6	108.7	251.3
Foreign Total Costs (\$10 ⁶)	3642.5	4269.2	5308.4	5860.1	6976.0
Estimated Foreign Fixed Costs (\$10 ⁶)	1225.	1272.	1492.	1435.	1535.
Estimated Foreign Variable Costs (\$10 ⁶)	2418.	2997.	3816.	4425.	5441.
Foreign Automotive Units (Thousands)	1503.	1591.	1592.	1370.	1376.
Revenue/Unit, Foreign, (\$)	2736.	2980.	3630.	4357.	5252.
Variable Cost/Unit, Foreign (\$)	1608.	1884.	2397.	3230.	3954.
Variable Margin/Unit, Foreign, (\$)	1128.	1096.	1233.	1127.	1298.
BESV Foreign (Thousands)	1086.	1160.	1210.	1273.	1183.
North American Automotive Sales (\$10 ⁶)	22176.1	23666.6	27764.1	23011.4	25717.1
NAA Profits, Pretax (\$10 ⁶)	3315.5	3625.3	3952.2	1434.3	1930.3
NAA Total Costs (\$10 ⁶)	18860.6	20041.3	23811.9	21577.1	23786.8
NAA Estimated Fixed Costs (\$10 ⁶)	5895.	6125.	7181.	6907.	7389.
NAA Estimated Variable Costs (\$10 ⁶)	12966.	13916.	16631.	14670.	16398.
NAA Units (Thousands)	6276.	6200.	7092.	5320.	5253.
Revenue/Unit, NAA, (\$)	3533.	3817.	3915.	4325.	4896.
Variable Cost/Unit, NAA (\$)	2066.	2245.	2345.	2758.	3122.
Variable Margin/Unit, NAA (\$)	1467.	1572.	1570.	1567.	1774.
BESV NAA (Thousand Units)	4018.	3895.	4574.	4406.	4164.

TABLE 17. ESTIMATED VARIABLE AND FIXED COSTS CHARACTERISTICS FOR THE FOREIGN AUTOMOTIVE OPERATIONS (PASSENGER AND NON-PASSENGER AUTOS) OF THE DOMESTIC AUTO MANUFACTURERS.

YEAR	1971	1972	1973	1974	1975
MANUFACTURER	UNIT SALES (10 ⁶ VEHICLES/YR)				
CHRYSLER	870	1025	1203	993	912
FORD	1582	1745	1763	1529	1545
GMC	1503	1591	1592	1370	1376
	AVERAGE REVENUE/UNIT (DOLLARS)				
CHRYSLER	2200	2400	2900	3400	4400
FORD	2600	2900	3300	4300	5100
GMC	2700	3000	3600	4300	5300
	AVERAGE VARIABLE COST/UNIT DOLLARS				
CHRYSLER	1500	1800	2200	2700	3700
FORD	1900	2000	2300	3300	4000
GMC	1600	1900	2400	3200	4000
	AVERAGE VARIABLE MARGIN (DOLLARS)				
CHRYSLER	700	600	700	700	700
FORD	700	900	1000	1000	1100
GMC	1100	1100	1200	1100	1300
	ESTIMATED FOREIGN FIXED COSTS (MILLION DOLLARS)				
CHRYSLER	550	520	600	650	610
FORD	980	1100	1300	1300	1300
GMC	1200	1300	1500	1400	1500
	BREAK EVEN PRODUCTION (10 ³ VEHICLES/YEAR)				
CHRYSLER	790	900	900	1000	900
FORD	1300	1300	1200	1300	1200
GMC	1100	1200	1200	1300	1200

TABLE 18. ESTIMATED VARIABLE AND FIXED COSTS CHARACTERISTICS FOR THE NORTH AMERICAN AUTOMOTIVE OPERATIONS (PASSENGER AND NON-PASSENGER AUTOS) OF THE DOMESTIC AUTO MANUFACTURERS.

YEAR	1971	1972	1973	1974	1975
MANUFACTURER	UNIT SALES (10^3 VEHICLES/YR)				
AMC	378	437	552	585	524
CHRYSLER	1793	2003	2199	1769	1564
FORD	3351	3848	4102	3730	3083
GMC	6276	6200	7092	5320	5253
	AVERAGE REVENUE/UNIT (DOLLARS)				
AMC	3300	3200	3100	3400	4300
CHRYSLER	3100	3300	3500	3900	4500
FORD	3300	3500	3600	4000	4600
GMC	3500	3800	3900	4300	4900
	AVERAGE VARIABLE COSTS/UNIT (DOLLARS)				
AMC	2500	2400	2300	2600	3500
CHRYSTER	2300	2500	2700	3200	3700
FORD	2200	2400	2500	3000	3500
GMC	2000	2200	2300	2800	3100
	AVERAGE VARIABLE MARGIN (DOLLARS)				
AMC	800	800	800	800	800
CHRYSLER	800	800	800	700	800
FORD	1100	1100	1100	1000	1100
GMC	1500	1600	1600	1500	1800
	ESTIMATED NAA FIXED COSTS (MILLION DOLLARS)				
AMC	280	320	380	410	450
CHRYSLER	1300	1200	1400	1400	1500
FORD	2600	3000	3300	3400	3400
GMC	5900	6100	7200	6900	7400
	BREAK EVEN PRODUCTION (10^3 VEHICLES/YR)				
AMC	360	400	460	540	580
CHRYSTER	1700	1600	1900	1900	1800
FORD	2400	2800	3200	3500	3100
GMC	4000	3900	4600	4400	4200

4. U.S. AUTOMOBILES AND LIGHT TRUCKS

4.1 INTRODUCTION AND METHODOLOGY

The top down methodology used in the prior sections was expanded to establish the historical relationships between the cost of making automobiles and light trucks (with a G.V.W. of less than 6000 lbs.) in this country and the revenue derived therefrom, for each of the major domestic auto manufacturers. The task was principally one of identifying and isolating from consolidated corporate data the revenue and cost elements associated with U.S. manufacture of automobiles and light trucks. The method first entailed the disaggregation of U.S. operations from Canadian and foreign operations, and automotive from non-automotive operations. Focus was then placed on the manufacture of automobiles and light trucks (A+LT) within U.S. Automotive Operations, which include the manufacture of automotive parts and heavy trucks (with a GVW greater than 6000 lbs). To arrive at the desired numbers, it was necessary to make significantly more assumptions than were previously required for the cost-revenue analysis of the worldwide automotive and North American automotive operations. The methodology and assumptions used are described in detail in Appendix A.

Fixed and variable costs are presented in more detail for U.S. A+LT operations than was done in the prior analysis. Fixed costs in the A+LT work are defined slightly differently than the fixed costs used in the prior analysis. Fixed cost categories common to all the analyses include Depreciation, Amortization, Research and Development Expense, Selling Costs and General Administrative Expense and Interest.

In the analysis of U.S. A+LT operations, taxes other than income taxes were broken down into state and local property taxes, which were considered to be identifiable fixed costs; payroll taxes and social security payments for salaried employees which were considered to be included in the costs of R&D or SGA; and payroll taxes and social security payment for hourly workers,

which were considered to be components of variable costs. Pensions and retirement payments for salaried employees were treated as a component of fixed costs whereas pension and retirement payments for hourly workers were treated as part of variable costs. Advertising expenses were considered to be included in selling costs and general administrative expenses, and were not worked separately. Maintenance and repairs were treated as a variable cost rather than as a fixed cost.

In order to obtain a better estimate of the breakeven volume, payments to the incentive programs, which depend on the earnings of the corporation, were treated as parts of pretax earnings rather than as parts of fixed costs. The rationale behind this assumption is that there are no incentive program payments when there are no profits.

Variable cost categories identified other than the ones mentioned above included Production Labor Wages, Production Labor Benefits, Excise Taxes, Warranty Costs, the cost of purchased materials and the cost of energy.

4.2 DATA

Financial data for the U.S. manufacture of automobiles and light trucks (GVW of less than 6000 lbs) for each of the major domestic auto manufacturers are summarized in the following tables:

American Motors Corp.	Tables 19 and 20
Chrysler Corp.	Tables 21 and 22
Ford Motor Co.	Tables 23 and 24
General Motors Corp.	Tables 25 and 26

Inter-company comparisons are presented in Table 27. The data developed for American Motors Corp., which mainly operates in the United States, were based on the financial figures and other information on the company's worldwide operations. The results for worldwide automotive operation are assumed to represent U.S. operations as well.

TABLE 19. AMERICAN MOTORS CORPORATION WORLDWIDE AUTOMOBILE AND LIGHT TRUCK MANUFACTURE

BREAKDOWN OF CONSOLIDATED SALES & PROFITS	YEAR					
	1975	1974	1973	1972	1971	
	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(%)
Corporate Sales	2282.2	2000.2	1739.0	1403.8	1232.6	
Corporate Pretax Earnings	(35.5)	41.9	75.6	31.8	11.2	
Corporate Pretax Earnings - Corp Sales						0.9
Automotive Sales	1909.2	1318.0	1587.3	1173.6	974.5	79.1
Automotive Pretax Earnings	(37.6)	54.8	76.8	23.8	0.7	
Automotive Pretax Earnings % Corp Earnings	(105.9)	130.8	101.6	75.3	6.3	
Auto & Light Truck Sales (No parts)	1718.2	1636.2	1428.6	1056.2	877.0	71.2
Auto & Light Truck Sales (No parts) Corp Sales						(54.5)
Auto & Light Truck Pretax Earnings	(51.0)	42.1	65.7	15.6	(6.1)	
Auto & Light Truck Pretax Earnings & Corp Savings	1769.2	1594.1	1362.9	1040.6	883.2	100.7
Auto & Light Truck Total Costs						
Auto & Light Truck Total Costs - Auto & L.T. Sales						
AUTO & LIGHT TRUCK COST BREAKDOWN	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(%TOTAL COSTS)
Non-Variable Costs	244.3	214.8	203.1	176.7	160.0	18.1
Depreciation, Plant Prop & Equip	15.1	12.3	10.8	11.0	10.7	1.2
Amortization of Special Tools	27.2	18.4	16.0	18.1	17.3	2.0
R&D	28.3	29.5	29.5	22.1	19.4	2.2
Selling Costs & Gen Admin Exp	145.4	135.0	127.5	106.5	96.5	10.9
Interest	12.7	5.2	5.1	5.0	4.7	0.5
State & Local Prop Taxes	5.6	4.6	6.1	5.5	5.0	0.8
Pension & Retirement Salaried Employees	10.5	9.7	7.9	6.6	6.4	0.7
Variable Costs	1324.9	1379.3	1159.8	855.9	723.2	81.9
Maintenance & Repairs	33.1	35.8	33.4	22.1	16.3	1.8
Production Labor-Wages	182.9	178.8	151.3	116.7	96.2	10.9
Production Labor-Benefits (Insurance, Pension and Payroll Taxes)	38.6	35.4	30.2	23.4	19.3	2.2
Excise Taxes	6.2	6.8	6.4	5.0	4.3	0.5
Warranty Costs (2.8% Sales)	48.1	45.8	40.0	29.6	24.6	2.8
Purchased Production Materials Components	1200.0	1073.3	894.0	565.8	559.7	63.4
Utilities-Energy	6.0	5.4	4.5	3.3	2.8	0.3
Production, Auto & Light Trucks						
CALC. Break Even Production (B.E.S.V.)						
Ratio, Production/ B.E.S.V.						
Variable Lost/Unit (\$)						
	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)	
	495	545	514	402	345	
	626.	656	389	369	359	
	3081	2531	2256	2154	2096	0.96

TABLE 20. AMERICAN MOTORS CORP HISTORICAL COST-REVENUE RELATIONSHIP PER VEHICLE FOR WORLDWIDE MANUFACTURE OF AUTOMOBILES AND LIGHT TRUCKS

(LESS THAN 6000 GVW)

ITEM \ YEAR	1971	1972	1973	1974	1975	1976*	1971
REVENUE/VEHICLE (\$)	2542	2627	2779	3002	3471		2542
PRETAX EARNINGS/VEHICLE (\$)	(18)	39	128	77	(103)		(18)
TOTAL COSTS/VEHICLE (\$)	2560	2588	2652	2925	3574		2560
VARIABLE COSTS/VEHICLE (\$)	2096	2154	2256	2531	3081		2096
VARIABLE MARGIN/VEHICLE (\$)	446	473	523	471	390		446
PRETAX MARGIN %	(0.7)	1.5	4.8	2.6	(2.9)		(0.7)
ACTUAL PRODUCTION (10 ³ UNITS)	345	402	514	545	495		345
CALCULATED BEP (10 ³ UNITS)	359	369	389	456	626		359

*NOT AVAILABLE AT THIS TIME

TABLE 21. CHRYSLER CORPORATION -U.S. AUTOMOBILE AND LIGHT TRUCK MANUFACTURER

BREAKDOWN OF CONSOLIDATED SALES AND PROFITS	YEAR					
	1975	1974	1973	1972	1971	
Corporate Sales	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(%)
Corporate Earnings (Pretax)	11598.4	10860.0	11667.4	9640.7	7892.6	
Corporate Earnings % Corp Sales	(180.4)	(119.8)	468.5	418.4	157.0	2.0
Worldwide Automotive Sales	11289	10569	11391	9386	7677	97.3
Worldwide Automotive Sales % Corp Sales						
Worldwide Automotive Earnings Pretax	(190.1)	(128.5)	460.2	4107	150.5	95.9
Worldwide Automotive Earnings % Corp Savings						
U.S. Automotive Sales (Estimate)	6057	6122	7070	6199	5234	66.3
U.S. Automotive Sales (Estimate) % Corp Sales						
U.S. Automotive Earnings, Pretax (Estimate)	(125.8)	(91.2)	222.3	320.3	135.4	86.2
U.S. Automotive Earnings, Pretax % Corp Earnings						
U.S. Auto & L.T. Sales (No Parts)	4870	5009	5707	4992	4348	56.1
U.S. Auto & L.T. Sales % Corp Sales						
U.S. Auto & L.T. Earnings % Corp Earnings	(150.2)	121.9	155.0	247.8	91.2	58.0
Incentive Program, U.S. Auto & L.T.	-	-	5.9	8.7	-	-
Incentive Program, U.S. Auto & L.T. Sales						
U.S. A & L.T. Total Costs (Without Inc. Program)	5020	5131	5546	4735	4257	97.9
U.S. A & L.T. Total Costs % Auto & L.T. Sales	103.1	102.4	97.2	94.9		
U.S. AUTO & LIGHT TRUCK COST BREAKDOWN						
Non-Variable Costs	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(\$10 ⁶)	(% TOTAL COST)
Depreciation Prop. Plant & Equip.	547.9	649.1	619.5	550.8	495.8	11.6
Amortization Special Tools	59.9	88.9	88.3	82.6	82.7	1.7
Research & Development	82.8	67.9	95.6	94.2	87.0	2.0
Rolling Costs & Gen Admin. Exp.	96.6	116.6	122.6	91.2	68.8	1.6
Interest	226.1	237.0	231.5	200.9	176.1	4.1
State & Local Property Taxes	81.8	52.6	16.1	27.3	33.6	0.8
Pensions-Salaried Employees	37.3	29.0	23.8	19.6	16.5	0.4
Variable Costs	63.5	57.1	41.6	35.1	31.2	0.7
Maintenance & Repairs	4372.1	4481.9	4926.5	4184.2	3761.2	88.4
Production Labor-Wages & Benefits	127.5	157.5	199.4	160.7	137.6	3.2
Excise Taxes	992.5	1092.3	1221.9	966.1	819.3	19.2
Warranty Costs (2-8%)	13.8	117.8	22.1	19.6	17.9	0.4
Purch. Prod. Materials & Components	136.4	140.3	159.8	139.8	121.7	2.9
Energy Utilities	3086.1	3058.7	3306.7	2893.5	2651.4	62.3
Production-Auto & Light Trucks	14.1	15.3	16.6	14.5	13.4	0.3
Ratio Prod/8 E.P.	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)	
Variable Cost/unit \$	1101	1426	1776	1568	1428	
	1431	1754	1355	1068	1206	
	3971	3143	2774	2668	2634	1.18

TABLE 22. CHRYSLER CORPORATION - HISTORICAL COST-REVENUE RELATIONSHIP PER VEHICLE FOR U.S. MANUFACTURE OF AUTOMOBILES AND LIGHT TRUCKS (LESS THAN 6000 LBS GVW)

	1976*	1975	1974	1973	1972	1971
REVENUE/VEHICLE (\$)		4423	3513	3231	3184	3045
PRETAX EARNINGS/VEHICLE (\$)		(136)	(85)	91	164	64
TOTAL COSTS/VEHICLE (\$)		4559	3598	3140	3020	2981
VARIABLE COSTS/VEHICLE (\$)		3971	3143	2774	2668	2634
VARIABLE MARGIN/VEHICLE (\$)		452	370	457	516	411
PRETAX MARGIN (%)		(3.0)	(2.3)	2.9	5.4	2.1
ACTUAL PRODUCTION (103 VEHICLES)		1101	1426	1766	1568	1428
CALCULATED BREAK-EVEN PRODUCTION (103 VEHICLES)		1433	1754	1355	1068	1206

*NOT AVAILABLE AT THIS TIME

TABLE 23. FORD MOTOR COMPANY U.S. AUTOMOBILE AND LIGHT TRUCK MANUFACTURER

BREAKDOWN OF CONSOLIDATED SALES & PROFITS	YEAR					1974					1973					1972					1971				
	(\$10 ⁶)	(%)	(\$10 ⁶)	(%)	(\$10 ⁶)	(\$10 ⁶)	(%)	(\$10 ⁶)	(%)	(\$10 ⁶)	(\$10 ⁶)	(%)	(\$10 ⁶)	(%)	(\$10 ⁶)	(\$10 ⁶)	(%)	(\$10 ⁶)	(\$10 ⁶)	(%)	(\$10 ⁶)	(\$10 ⁶)	(%)		
Corporate Sales,	24009.1		22620.6		23015.1		20194.1		20194.1		23015.1		20194.1		20194.1		23015.1		20194.1		20194.1		16443.0		
Corporate Earnings, Pretax	398.2		587.4		587.4		587.4		587.4		587.4		587.4		587.4		587.4		587.4		587.4		1292.4		
Corporate Earnings, % Corp Sales		1.7		2.6		2.6		2.6		2.6		2.6		2.6		2.6		2.6		2.6			7.9		
Automotive Sales, M.W.	21688		21528		21041		21041		21041		21041		21041		21041		21041		21041		21041		14998		
Automotive Sales, % Corp Sales		90.3		95.2		95.2		95.2		95.2		95.2		95.2		95.2		95.2		95.2			91.2		
Automotive Earnings, M.W. Pretax	296		482		482		482		482		482		482		482		482		482		482		1220		
Automotive Earnings, M.W., % Corp Earnings		74.3		82.1		82.1		82.1		82.1		82.1		82.1		82.1		82.1		82.1			94.4		
Automotive Sales, U.S.	12786		13835		13835		13835		13835		13835		13835		13835		13835		13835		13835		10008		
Automotive Sales, U.S., % Corp Sales		53.3		61.2		61.2		61.2		61.2		61.2		61.2		61.2		61.2		61.2			60.9		
Automotive Earnings, U.S., Pretax	35		349		349		349		349		349		349		349		349		349		349		1103		
Automotive Earnings, U.S., % Corp Earnings		8.8		59.4		59.4		59.4		59.4		59.4		59.4		59.4		59.4		59.4			85.3		
U.S. Automobile & Light Truck Sales	9059		10305		10305		10305		10305		10305		10305		10305		10305		10305		10305		7930		
U.S. Automobile & Light Truck, % Corp Sales		37.7		45.6		45.6		45.6		45.6		45.6		45.6		45.6		45.6		45.6			48.2		
U.S. Auto & L.T. Earnings, Pretax	(43)		209		209		209		209		209		209		209		209		209		209		909		
U.S. Auto & L.T. Earnings, Pretax % Corp Earnings		(10.8)		35.6		35.6		35.6		35.6		35.6		35.6		35.6		35.6		35.6			70.3		
Incentive Program, Auto & L.T.	-		-		-		-		-		-		-		-		-		-		-		31		
Incentive Program, % Auto & L.T. Sales		--		--		--		--		--		--		--		--		--		--			0.4		
U.S. A & LT Total Cost (Without Incentive Program)	9102		10096		10096		10096		10096		10096		10096		10096		10096		10096		10096		6990		
U.S. A & LT Total Cost, % Auto & L.T. Sales		100.5		98.0		98.0		98.0		98.0		98.0		98.0		98.0		98.0		98.0			88.1		
U.S. AUTO & LIGHT TRUCK COST BREAKDOWN	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	(\$10 ⁶)	(% TOTAL COST)	
Non-Variable Costs	1568.7	17.5	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1558.1	15.4	1179.8	16.9	
Depreciation, Plant, Prop & Equip.	264.4	2.9	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	239.6	2.4	193.2	2.8	
Amortization of Special Tools	197.2	2.2	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	177.2	1.8	179.3	2.6	
R&D	338.6	3.7	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	372.3	3.6	230.2	3.3	
Selling Costs & Gen Admin Expenses	465.5	5.2	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	465.7	4.6	397.8	5.7	
Interest	136.3	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	127.1	1.3	51.8	0.7	
State and Local Prop Taxes	91.6	1.0	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	89.6	0.9	73.0	1.0	
Pension-Salaried Employees	91.1	1.0	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	86.6	0.8	54.6	0.8	
Variable Costs	7513.3	82.5	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	8537.9	84.6	5810.2	83.1	
Maintenance & Repairs	251.0	2.8	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	334.6	3.3	239.2	3.4	
Production Labor-with Benefits	1518.0	16.7	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1728.0	17.1	1243.0	17.8	
Excise Taxes	26.6	0.3	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	35.7	0.4	34.7	0.5	
Warranty Costs (2.8% Sales)	253.6	2.8	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	288.5	2.9	222.0	3.2	
Purchased Production Materials & Components	5436.8	59.7	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	6120.3	60.6	4050.9	58.0	
Utilities-Energy	27.3	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	30.7	0.3	20.4	0.3	
Auto & L.T. Production	2131		2856		2856		2856		2856		2856		2856		2856		2856		2856		2856		2772		
Auto L.T. Calc. Breakeven Production(B.E.P)	2190		2545		2545		2545		2545		2545		2545		2545		2545		2545		2545		1542		
Ratio Production/B.E.P.		0.97		1.12		1.12		1.12		1.12		1.12		1.12		1.12		1.12		1.12			1.80		
Variable Cost/Unit (\$)	15246		2996		2605		2605		2605		2605		2605		2605		2605		2605		2605		2384		

TABLE 24. FORD MOTOR COMPANY HISTORICAL COST-REVENUE RELATIONSHIP PER VEHICLE FOR U.S. MANUFACTURE OF AUTOMOBILES AND LIGHT TRUCKS

(LESS THAN 6000 LBS GVW)

ITEM	YEAR						
	1971	1972	1973	1974	1975	1976*	1977
REVENUE/VEHICLE (\$)	2861	3152	3322	3608	4251		
PRETAX EARNINGS/VEHICLE (\$)	339	320	255	73	(20)		
TOTAL COST/VEHICLE (\$)	2522	2832	3067	3535	4271		
VARIABLE COSTS/VEHICLE (\$)	2096	2394	2605	2996	3526		
VARIABLE MARGIN/VEHICLE (\$)	765	758	717	612	725		
PRETAX MARGIN %	13.4	11.3	8.3	2.1	(0.5)		
ACTUAL PRODUCTION (10 ³ UNITS)	2772	3108	3287	2856	2131		
CALC. BEP (10 ³ UNITS)	1542	1794	2116	2545	2190		

*NOT AVAILABLE AT THIS TIME

TABLE 25. GENERAL MOTORS CORPORATION U.S. AUTOMOBILE AND LIGHT TRUCK MANUFACTURER

BREAKDOWN OF CONSOLIDATED SALES & PROFITS	YEAR									
	1975	1974	1973	1972	1971					
	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)
Corporate Sales (After Elimination of Inter-Company (I.C.) Sales)	35724.9	31549.5	35798.3	30435.2	28263.9					
Corporate Earnings (Pretax)	2371.3	1677.1	4513.1	4222.6	3719.8					
Corporate Earnings, Corp Sales										14.2
Automotive Products, Gross U.S. Sales	26137.3	23446.7	28116.6	23894.8	22619.1					
Automotive Products, U.S. Sales (After Elimination of I.C. Sales)	22421.5	20106.1	25209.2	21609.3	20112.3					71.2
Automotive Products U.S. Sales, Corp Sales										
Automotive Products, U.S. Pretax Earnings	1025	1358	3791	3589	3311					89
Automotive Products, U.S. Corp Earnings										
U.S. Automobile & Light Truck Sales	17513	15775	20398	17743	16700					59.1
U.S. Automobile & Light Truck, Corp Sales										
U.S. Automobile & Light Truck Pretax Earnings	1448	1101	3170	3045	2841					76.4
U.S. Automobile & Light Truck, Corp Earnings										
Incentive Program, U.S. Auto & Light Truck	20	4	79	73	68					
Incentive Program, U.S., U.S. Auto & L.T. Sales										
U.S. Auto & L.T. Total (Without Incentive Program)	16045	14670	17149	14625	13791					82.6
U.S. Auto & L.T. Total, U.S. Auto & L.T. Sales										
AUTO & LIGHT TRUCK BREAKDOWN										
	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)	(10 ⁶ \$)
Non-Variable Costs	3022	2741	2363	2302	2233					
Depreciation Prop. Plant & Equip.	91	459	128	195	130					3.3
Amortization Special Tools	641	465	313	300	273					3.4
R&D	605	610	409	423	434					3.3
Selling Costs & Gen Admin Expenses	725	739	609	637	612					4.4
Interest	160	100	31	20	29					0.2
State & Local Property Taxes	210	189	151	162	144					1.0
Pensions-Salaried Employees	210	190	139	75	71					0.5
Variable Costs	13003	11029	12766	12316	11538					83.8
Maintenance & Repairs	830	922	1111	909	836					6.0
Production Labor-Wages	3094	2990	3633	3100	2872					20.8
Production Labor- Benefits (Insurance, Pension & Retirement Payroll Taxes)	953	920	866	398	357					4.0
Excise Taxes	32	53	75	67	68					0.3
Warranty Costs (2-S. Sales)	90	112	371	497	468					3.4
Purchased Production Materials & Components	730	639	537	690	676					49.0
Utilities-Energy	48	39	53	35	31					0.2
	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)	(10 ³ units)					
Production, Auto & Light Truck	149	145	6029	5300	5498					2.36
Calculated Breakeven Production (S.E.P.) Ratio, Production S.E.P.	2400	3025	2552	2293	2360					2.36
Variable Cost Unit (\$)	313	2810	2519	2252	2125					2.36

TABLE 26. GENERAL MOTORS CORP HISTORICAL COST-REVENUE RELATIONSHIP PER VEHICLE FOR U.S. MANUFACTURE OF AUTOMOBILES AND LIGHT TRUCKS

(LESS THAN 6000 LBS G.V.W.)

ITEM	YEAR	1976*	1975	1974	1973	1972	1971
REVENUE/VEHICLE (\$)			4221	3716	3383	3292	3071
PRETAX EARNINGS/VEHICLE (\$)			354	260	539	579	535
TOTAL COST/VEHICLE (\$)			3867	3456	2844	2713	2536
VARIABLE COST/VEHICLE (\$)			3134	2810	2449	2285	2125
VARIABLE MARGIN/VEHICLE (\$)			1087	906	934	1007	946
PRETAX MARGIN %			9.2	7.5	19.0	21.3	21.1
ACTUAL PRODUCTION (10 ³ UNITS)			4149	4245	6029	5390	5438
CALC B.E.P. (10 ³ UNITS)			2799	3025	2552	2293	2360

*NOT AVAILABLE AT THIS TIME

TABLE 27. ESTIMATED VARIABLE AND FIXED COSTS CHARACTERISTICS FOR U.S. MANUFACTURE OF PASSENGER AUTOMOBILES AND LIGHT TRUCKS (LESS THAN 6000 LBS GVW) OF THE DOMESTIC AUTO MANUFACTURERS

YEAR	1971	1972	1973	1974	1975
UNIT SALES (10^3 VEHICLES 1 YR)					
AMC	345	402	514	545	495
CHRYSLER	1428	1568	1776	1426	1101
FORD	2772	3108	3287	2850	2731
GMC	5438	5390	6029	4245	4149
AVERAGE REVENUE/UNIT (DOLLARS)					
AMC	2500	2600	2800	3000	3500
CHRYSLER	3000	3200	3200	3500	4400
FORD	2900	3200	3300	3600	4200
GMC	3100	3300	3400	3700	4200
AVERAGE VARIABLE COSTS/UNIT, (DOLLARS)					
AMC	2100	2100	2300	2500	3100
CHRYSLER	2600	2700	2800	3100	4000
FORD	2100	2400	2600	3000	3500
GMC	2100	2300	2500	2800	3100
AVERAGE VARIABLE MARGIN (DOLLARS)					
AMC	400	500	500	500	400
CHRYSLER	400	500	400	400	400
FORD	800	800	700	600	700
GMC	1000	1000	900	900	1100
ESTIMATED FIXED COSTS (MILLION DOLLARS)					
AMC	160	170	200	210	240
CHRYSLER	500	550	620	650	650
FORD	1200	1400	1500	1600	1600
GMC	2200	2300	2400	2700	3000
BREAK EVEN PRODUCTION (10^3 VEHICLES/YR)					
AMC	360	370	390	460	630
CHRYSLER	1200	1100	1400	1800	1400
FORD	1500	1800	2100	2500	2200
GMC	2400	2300	2600	3000	2800

4.3 DISCUSSION

Examination of the per vehicle cost/revenue charts indicate the following general trends about the manufacture of automobiles and light trucks in the United States:

1. Both the price (revenue) and cost of automobiles and light trucks increased annually between 1971 and 1975. Costs have increased more rapidly than revenue, resulting in decreasing profit margins during this period.
2. Cost increases between 1971 and 1975 were principally due to increases in variable costs, which represent approximately eighty percent of the total cost of a vehicle. Non-variable costs have increased significantly less on an actual dollar basis. This, in part, reflects some significant cost cutting of overhead operations by the manufacturers in 1974 and 1975.
3. Non-variable costs vary to some extent with planned production volume as discussed in Appendix A. This is the result of management's decision to expand or contract their programmed fixed cost allocations depending upon sales forecasts.
4. Break even production levels (BESV) generally increased up to 1974. This occurred principally because of a decrease in profit margins. For the three major manufacturers, the BESV decreased in 1975 as compared to 1974. This is a reflection of a reduction in the non-variable cost base. For American Motors Corp., there has been a continuous escalation of the BESV from about 350,000 vehicles/year in 1971 to 600,000 vehicles/year in 1975. The 1975 BESV is greater than this company's maximum historic production level.
5. General Motors Corporation obtains the highest price per vehicle and also has the highest profit margin of the four major U.S. automobile manufacturers. This is reflected in the data shown in Table 28. It is the only

manufacturer that has shown a profit every year between 1971 and 1975 on its U.S. automobile and light truck production operations.

TABLE 28. AVERAGE 1971-1973 PRETAX MARGINS ON U.S. AUTOMOBILE AND LIGHT TRUCK MANUFACTURE (LESS THAN 600 LBS GVW)

COMPANY	PRETAX MARGINS ^(a) 1971-1973 AVERAGE
AMC ^(b)	2.3%
CHRYSLER CORP.	3.5%
FORD MOTOR CO.	10.7%
GENERAL MOTORS CORP.	20.4%

$$(a) \text{ Pretax Margin} = \frac{\text{Pretax Earnings}}{\text{Total Costs}}$$

(b) AMC Worldwide Operations

6. Further support for this analysis is given by comparing the results of this analysis to calculations of average wholesale price based on data published by the Council on Wage and Price Stability (CWPS). As presented in Table 29, the results agree within five percent.

TABLE 29. COMPARISON OF WHOLESALE PRICE ESTIMATES FOR 1975 VEHICLES

MANUFACTURER	AVERAGE WHOLESALE PRICE OF 1975 VEHICLES, \$		DIFFERENCE IN DOLLARS ((2) - (1)) AND A PERCENT OF (1)	
	AUTOMOBILES ¹ (CWPS DATA) (1)	AUTO & LIGHT TRUCKS (THIS ANALYSIS) (2)	Δ , \$ (2) - (1)	$\Delta\%$ OF (1)
AMC	3451	3471	+20	0.6
CHRYSLER	4298	4423	+125	2.9
FORD	4196	4251	+55	1.3
GMC	4450	4221	-229	-5.1

¹ SOURCE: Executive Office of the President Council on Wage and Price Stability "1976 Automobile Prices" Nov. 11, 1975.

APPENDIX A
CONTRIBUTION OF AUTOMOBILES AND LIGHT TRUCKS
TO AUTOMOTIVE SALES AND EARNINGS

A-1 INTRODUCTION

The automotive business is identified as a separate line item by the four major automotive manufacturers. In all cases, sales revenue, earnings before taxes, and the number of automobiles and trucks sold for the corporate fiscal year are published in the annual reports.

For the purpose of the present analysis, the automotive business line is considered to consist of three subgroups:

- 1) Automobiles and light trucks (GVW < 6000 lbs),
- 2) Heavy trucks with a GVW > 6000 lbs, and
- 3) Parts for automobiles and light trucks.

The contribution of automobiles and light trucks to a company's automotive business is the residue obtained after subtracting the contribution of parts and heavy trucks to automotive operations.

A-2 CONTRIBUTION OF PARTS

The sale of parts is assumed to be 10 percent of automotive sales for all four manufacturers. It is possible to estimate the order of magnitude of the fraction of automotive sales of the four major automotive manufacturers that are not due to the sale of vehicles (cars and trucks). These are considered here as "parts sales." Parts sales for 1975 are estimated for each of the major manufacturers as shown in Table A-1. For each corporation, the SEC 10K form provides information on sales volume of the automotive business line, which is considered here as consisting of the manufacturer of passenger vehicles, trucks and "parts." The factory unit sales of cars and trucks are also given. The value of cars sold by a given manufacturer is obtained by multiplying the number of cars sold in 1975 by the average wholesale price of cars sold by the manufacturer in 1975, as published by

TABLE A-1. ESTIMATE OF 1975 PARTS SALES OF FOUR MAJOR AUTOMOTIVE MANUFACTURERS

COMPANY	AMC		CHRYSLER		FORD		GMC	
AREA	. W.W.		U.S.		U.S.		U.S.	
		(\$10 ⁶)		(\$10 ⁶)		(\$10 ⁶)		(\$10 ⁶)
AUTOMOTIVE SALES		1,909		6,057		12,786		23,108*
FACTORY SALES, AUTOMOBILES	495,000		970,127		1,898,000		3,680,000	
AVERAGE VALUE AUTOMOBILE (CWPS)	\$3,451		\$4,298		\$4,196		\$4,450	
AUTOMOBILE SALES		1,708		4,170		7,964		16,376
FACTORY SALES TRUCKS			327,681		779,000		978,000	
AVERAGE VALUE TRUCKS, U.S. (MVMA, CENSUS OF MFG.)			\$4,556		\$4,556		\$4,556 (\$5,147)**	
TRUCK SALES				1,493		3,549		4,456 (5,034)
AUTOMOBILE AND TRUCK SALES				5,663		8,371		20,832
"PARTS" SALES (BY DIFFERENCE)		1,708		394		1,273		(21,410)
"PARTS" SALES/AUTOMOTIVE SALES X 100, %	10.5		6.50		9.96		9.85 (7.35)	2,276 (1,698)
BERNSTEIN ESTIMATE (1/21/76) % PARTS			4.1		5.0		6.2	
*Corrected for intercompany sales. **Pioneer.								

the Council on Wage and Price Stability. The value of trucks sold by a given manufacturer is estimated by multiplying the number of trucks sold in 1975 by the average wholesale price of trucks sold in the U.S. in 1975, which is estimated at \$4556/unit, based on MVMA and Census data. Company-specific data was not found except for GMC in the Pioneer Report. The value of parts for each company is obtained by subtracting the values of cars and trucks from total automotive sales.

The pretax earnings from parts are considered to be non-proportional to automotive earnings. For lack of better data, pretax earnings derived from parts are assumed to be equal to a nominal seven percent of parts sales, based on the number developed by Eisenberg and presented in the lower half of Table A-2. If the profit margin on automobiles is less than 7 percent, this assumption tends to depress the earnings due to automobile sales. If the profit margins are higher, the converse is true.

Assuming a constant average value for trucks for all companies, the total sale of parts in the U.S. (treating AMC worldwide as a domestic manufacturer) is about \$4.1 billion, which is 9.5 percent of the total automotive sales of \$43.9 billion for the four companies. On a company-specific basis, assuming a constant truck value, parts sales are about 10 percent for all the companies except Chrysler, for which a value of 6.5 percent is calculated. If the average price of a GMC truck is assumed to be \$5147 instead of \$4556, the percentage of automotive sales due to parts is 7.35 percent instead of 9.85 percent.

The above values are higher than the approximate 5 percent used in the Bernstein industry analyses and previously used in the November 1 draft of the AFER Support Study Report, as shown in Table A-2.

A value of 10 percent of automotive sales due to parts for the major automotive manufacturer is of the same magnitude as the sale of manufacturers parts as a percentage of new vehicles and manufacturers parts by franchised automobile and truck dealers, as shown in Table A-3. If it is assumed that franchised dealers only

TABLE A-2. CONTRIBUTION OF PARTS TO AUTOMOTIVE SALES AND EARNINGS

<u>MANUFACTURER</u>	<u>CHRYSLER</u>	<u>FORD</u>	<u>GMC</u>
<u>YEAR</u>	<u>PARTS SALES AS PERCENT AUTOMOTIVE SALES</u>		
1973	4.3	4.4	5.0
1974E	4.7	4.4	5.8
1975E	5.9	5.1	6.5
1978E	3.7	3.3	4.1
AVERAGE	4.5	4.2	5.1
	<u>PARTS PRETAX EARNINGS AS% PARTS SALES</u>		
1973	7.7	7.0	10 %
1974E	7.2	6.3	9.3
1975E	6.1	5.5	8.6
1978E	7.2	5.8	8.0
AVERAGE	7.0	5.6	8.0

SOURCE: David Eisenberg, "Automobile Industry," 1975 Earnings Estimates, Analysis of Long Term Earnings Power," Sanford C. Bernstein & Co., Inc., New York.

TABLE A-3. RELATIVE SALES OF MANUFACTURERS PARTS
AND NEW VEHICLES BY FRANCHISED DEALERS.

	<u>1973</u> <u>(\$10⁶)</u>	<u>1974</u> <u>(\$10⁶)</u>
TOTAL SALES OF PARTS BY FRANCHISED NEW CAR AND TRUCK DEALERS (1)	6502	7009
OTHER SALES	<u>509</u>	<u>554</u>
ESTIMATE SALE MFGS. PARTS	5993	6655
U.S. FACTORY SALES PASSENGER CARS AND TRUCKS (2)	35784.1	31816.2
LESS EXPORTS (2)	<u>2656.4</u>	<u>3725.2</u>
U.S. FACTORY SALES - DOMESTIC	33127.7	28091.0
ESTIMATE OF WHOLESALE VALUE OF EQUIPPED CARS AND TRUCKS (3)	41410	35390
IMPORTS - CARS AND TRUCKS	<u>6996</u>	<u>8190</u>
TOTAL VEHICLE SALES, WHOLESALE	48406	43585
ESTIMATE OF RETAIL VALUE OF CARS AND TRUCKS (25% MARKUP)	60510	54480
RETAIL VALUE MFG. PARTS AND VEHICLE	66503	61136
MFG. PARTS AS PERCENT ABOVE	9.0	10.9

sell through franchised dealers, the results of Tables A-1 and A-3 reinforce each other.

The sales and earnings of parts are subtracted from automotive sales and earnings, respectively, to obtain the sales and earnings of automobiles and trucks without parts.

A-3. CONTRIBUTION OF HEAVY TRUCKS (G.V.W. OVER 6000 POUNDS)

A listing by manufacturer of the number of truck and bus shipments from U.S. plants by G.V.W. classes on a calendar year basis is published in Ward's Automotive Yearbook (). This data can be used to calculate the ratio of light trucks to all trucks and buses sold by the manufacturer in the U.S. that calendar year.

The manufacturers' factory shipments (either U.S., North American or worldwide) of trucks and buses by fiscal year are published in the corporate annual reports. The number of light trucks shipped during the fiscal year in the area of interest (usually the U.S.) is obtained by multiplying the ratio obtained from Ward's Yearbook by truck shipments as published in the corporate report. The number of heavy trucks is the difference between the total number of trucks shipped and the number of light trucks shipped.

The relative value of trucks of different weight classes can be established on the basis of census data, as shown in Table A-4. While the absolute value of any truck of any category is time dependent, the relative values of trucks of different weight classes should not vary significantly with time.

By multiplying the relative value factors given in Table A-4 by the truck production data by G.V.W. class given in Ward's, it is possible to determine the relative value of all the trucks shipped by a manufacturer to that of light trucks weighing less than 6,000 lbs.

The Census of Manufacturers also provides data from which it is possible to calculate the relative prices of automobiles and light trucks, as shown in Table A-5. According to this table, the

TABLE A-4. AVERAGE 1967-1972 FACTORY PRICES OF TRUCKS OF DIFFERENT WEIGHT CLASSES
NORMALIZED TO THE PRICE OF AN AVERAGE LIGHT TRUCK (ACCORDING TO THE CENSUS OF
MANUFACTURERS) (1 of 2)

TRUCK G.V.W. CLASS, LBS.	AVERAGE FACTORY PRICE	1967 PRICE		1972 PRICE NORMALIZED TO PRICE OF LIGHT TRUCK	1967-1972 AVERAGE NORMALIZED PRICE RATIO
		NORMALIZED TO PRICE OF LIGHT TRUCK	AVERAGE FACTORY PRICE		
<6000	1866	1.00	2813	1.00	1.0
6000-10000	2054	1.10	3005	1.07	1.1±
10001	2500	1.34	3219	1.14	1.2
14001-16000	2559	1.37	5320	1.89	1.4*
16001-19500	2939	1.58	3858	1.37	1.7*
19501-26000	3759	2.01	6333	2.25	2.1
26001-33000	7124	3.82	9079	3.22	3.5
33001-44000	11304	6.06	15628	5.56	5.8
>44000	12679	6.80	19639	6.98	6.9
(>33000)	11914	6.39	(17037)	(6.06)	(6.2)
SALFS WEIGHED	2765	1.48	3917	1.39	1.4
AVERAGE TRUCK					

*INVERTING 1972 VALUES OF 14001-16000 LBS AND 160001-195000 LBS GTW TRUCKS

TABLE A-4. AVERAGE 1967-1972 FACTORY PRICES OF TRUCKS OF DIFFERENT WEIGHT CLASSES NORMALIZED TO THE PRICE OF AN AVERAGE LIGHT TRUCK (ACCORDING TO THE CENSUS OF MANUFACTURERS) (2 of 2).

$$\text{Value of all trucks} = (1.0) (S_1) + (1.1) (S_2) + \dots 2.5 (S_7) + 6.2 (S_8)$$

where:

S_1 = Shipments of trucks of 6000 lbs G.V.W. or less

S_2 = Shipments of trucks of 6001 - 10,000 lbs G.V.W.

" " " " " " " " "

" " " " " " " " "

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" " " " " " " " "

S_7 = Shipment of trucks of 26,001 - 33,000 lbs G.V.W.

S_8 = Shipment of trucks of more than 33,000 lbs G.V.W.

The relative value of heavy trucks to light trucks, x , is simply

$$x = \frac{\text{value of all trucks} - \text{value of light trucks}}{\text{value of light trucks}}$$

where value of light trucks = $S_1(1)$.

factory price of an automobile is higher than the factory price of a light truck by about 17 percent in 1972 and 42 percent in 1967. This variation in the relative prices of automobiles and light trucks in these two years is significantly higher than the variations in the relative prices of trucks of different weight classes to the value of a light truck, as shown in Table A-4 and Figure A-1. The variation of the relative prices of an average truck and an average light truck is much smaller than the variation in the relative prices of an average automobile and an average light truck. This is not surprising in that light trucks form a significant part of the total truck population.

The MVMA annual yearbook presents data on:

- a) U.S. factory unit sales of trucks and buses by GVW class,
- b) Total value of U.S. factory sales of trucks and buses, with standard options; and
- c) Total value and unit sales of passenger cars with standard options.

From these data, it is possible to estimate the relative prices of average automobiles with standard options and average light trucks with standard options produced in the U.S. in a given year. This value can be considered to be equal to the product of the following terms:

$$\frac{\text{Price Ave. Automobile (equipped)}}{\text{Price Ave. Light Truck (equipped)}} = \frac{\text{Price Ave. Automobile (stand.opt.)}}{\text{Price Ave. Truck (stand. opt.)}} \times \frac{\text{Price Ave. Truck (stand. opt.)}}{\text{Price Ave. Truck (equipped)}} \times \frac{\text{Price Ave. Truck (equipped)}}{\text{Price Ave. Light Truck (equipped)}} \times \frac{\text{Price Ave. Automobile (equipped)}}{\text{Price Ave. Automobile (stand. opt.)}}$$

If it is assumed that:

$$\frac{\text{Price Ave. Truck (equipped)}}{\text{Price Ave. Truck (stand. opt.)}} = \frac{\text{Price Ave. Automobile (equipped)}}{\text{Price Ave. Automobile (stand. opt.)}}$$

TABLE A-5. AVERAGE FACTORY PRICES OF AUTOMOBILES AND LIGHT TRUCKS
(ACCORDING TO THE CENSUS OF MANUFACTURERS).

<u>YEAR</u>	<u>1972</u>	<u>1967</u>
PASSENGER CARS (PRODUCT CODE 37111)		
NUMBER PRODUCED (1,000 UNITS)	8854.0	7319.7
VALUE (\$10 ⁶)	29246.2	19277.4
AVERAGE PRICE/UNIT (\$)	3303	2634
LIGHT TRUCKS, 6,000 LBS GVW AND LESS (PRODUCT CODE 37112-11)		
NUMBER PRODUCED (1,000 UNITS)	1306.7	918.3
VALUE (\$10 ⁶)	3675.5	1813.5
AVERAGE PRICE/UNIT	2813	1866
RELATIVE PRICE $\frac{\text{AVERAGE AUTOMOBILE}}{\text{AVERAGE LIGHT TRUCK}}$	1.17	1.42

then the above can be simplified to

$$\frac{\text{Price Ave. Automobile (equipped)}}{\text{Price Ave. Light Truck (equipped)}} = \frac{\text{Price Ave. Automobile (stand. opt.)}}{\text{Price Ave. Light Truck (equipped)}} \times \frac{\text{Price Ave. Truck (equipped)}}{\text{Price Ave. Light Truck (equipped)}}$$

The first term in the above is obtained from the unit sales and total value of passenger cars and trucks produced that year, as published by the MVMA. The second term is obtained from MVMA data on factory sales by GVW class and the values presented in Table A-4 on the relative prices of trucks of different weight classes.

The relative values of the prices of an average truck to average light truck are calculated for the years 1971 to 1975 inclusive as shown in Table A-6. These results are then used to calculate the values of the relative prices of automobiles and light trucks during this period, which are presented in Table A-7. Depending on the specific year, an average car is about 20 percent to 30 percent more expensive than an average light truck. For the period 1971 to 1975, the average relative value of the price of an automobile to that of a light truck is 1.24.

For estimate, it is assumed that automobiles and light trucks have the above relative value. The relative value of a manufacturer's automobile shipments to light truck shipments, y , is simply 1.24 times the ratio of the number of automobiles shipped to the number of light trucks shipped, (S_1) .

From the above, the value of automobiles and trucks shipped without parts, in terms of the value of light trucks shipped is $x + y + 1$. The fraction of the total automobile and truck sales (without parts) due to automobiles and light trucks is therefore

$$\frac{y + 1}{x + y + 1}.$$

It is assumed that the contribution of automobiles and light trucks to the earnings of automobiles and all trucks, is in proportion to the sales revenue. Therefore:

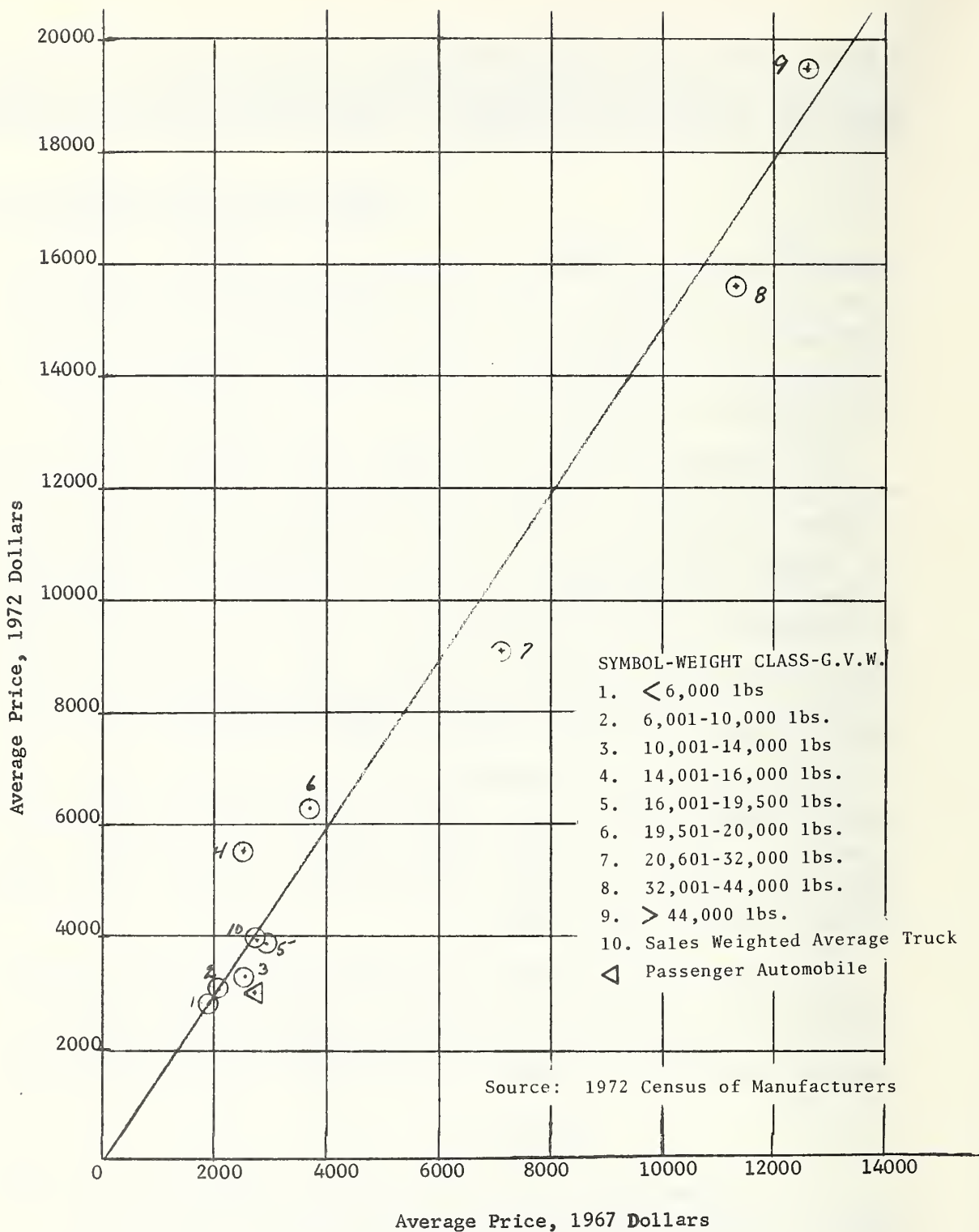


FIGURE A-1. RELATIVE AVERAGE PRICES OF TRUCKS OF DIFFERENT WEIGHT CLASSES IN 1967 AND 1972.

TABLE A-6. RELATIVE VALUES OF PRICE OF AN AVERAGE TRUCK TO THE PRICE OF AN AVERAGE LIGHT TRUCK, FOR 1967 AND THE YEARS 1971-1975.

YEAR	WEIGHT CLASS GVW, LBS	UNIT VALUE RELATIVE TO LIGHT TRUCKS	1975		1974		1973		1972		1971		1967	
			FACTORY SALES (UNITS)	VALUE	FACTORY SALES (UNITS)	VALUE	FACTORY SALES (UNITS)	VALUE	FACTORY SALES (UNITS)	VALUE	FACTORY SALES (UNITS)	VALUE	FACTORY SALES (UNITS)	VALUE
	6,000	1.0	928,511	928,511	1,536,178	1,536,778	1,735,645	1,735,645	1,735,645	1,414,551	1,196,544	1,196,544	899,986	889,986
	6,001-10,000	1.1	962,987	1,059,286	731,529	804,682	761,481	837,629	584,612	643,073	986,388	535,027	289,835	319,800
	10,001-14,000	1.2	14,342	17,210	9,094	10,913	44,724	53,669	44,221	53,065	17,928	21,514	5,207	6,248
	14,001-16,000	1.4	1,129	1,581	4,318	6,045	7,471	10,468	9,945	13,923	14,871	20,819	16,499	23,099
	16,001-19,500	1.7	10,582	17,989	13,071	22,220	18,941	32,200	28,080	47,736	58,042	98,671	88,213	149,962
	19,501-26,000	2.1	174,218	365,858	224,499	471,948	203,300	426,930	182,058	382,322	132,197	227,614	123,934	260,261
	26,001-33,000	3.5	27,310	95,585	34,432	120,512	42,200	147,700	42,213	147,746	36,441	127,544	37,960	132,860
	33,000	6.2	99,081	614,302	173,592	1,076,270	165,920	1,028,704	141,127	874,987	110,735	686,557	77,828	482,534
Total		1.36	2,272,160	3,100,322	2,727,313	4,048,968	2,979,688	4,272,945	2,446,807	3,577,403	2,053,146	2,964,290	1,539,462	2,274,050
Price Ave. Truck				1.36		1.48		1.43		1.46		1.44		1.48
Price Ave. Light Truck														
Price Ave. Light Truck														
Factory sales Based on WIMA Data														

Relative unit Values Based on Census of Manufacturers (See Table II.)

TABLE A-7. RELATIVE VALUES OF PRICE OF AN AVERAGE PASSENGER CAR TO AN AVERAGE LIGHT TRUCK.

YEAR	1975	1974	1973	1972	1971	1967
Factory Price Ave. Passenger Car (MVMA) (\$)	3486	2953	2717	2622	2494	2105
Factory Price Ave. Truck (MVMA) (\$)	3638	3726	3203	3128	2904	2333
$\frac{\text{Price Ave. Passenger Car}}{\text{Price Ave. Truck}}$	0.96	0.79	0.85	0.84	0.86	0.90
$\frac{\text{Price Ave. Truck}}{\text{Price Ave. Light Truck}}$ (See Table III.)	1.36	1.48	1.43	1.46	1.44	1.48
$\left(\frac{\text{Price Ave. Passenger Car}}{\text{Price Ave. Light Truck}} \right)$, based on above	1.31	1.18	1.22	1.23	1.24	1.34
$\left(\frac{\text{Price Ave. Passenger Car}}{\text{Price Ave. Lightruck}} \right)$, based on Census Data				1.17		1.42

$$\text{Automobile + Light Truck Earnings} = (\text{Automotive Earnings} - \text{Parts Earnings}) \frac{(y+1)}{(x+y+1)}$$

A-4. WARRANTY COSTS

Anticipated costs related to product warranty are expressed at the time of the sale of the products. It is possible to estimate warranty costs as a percent of vehicle sales on the basis of data published separately by the National Automobile Dealer's Association (NADA) and the Motor Vehicle Manufacturer's Association of the U.S. - (MVMA), as shown in Table A-8. Based on this data, it is estimated that warranty costs to the manufacturer represent slightly less than 3 percent of the value of vehicle sales.

These values are higher with percentage values derived from the 1971 Automotive Repair Industry Hearings Before the United States Senate Subcommittee on Antitrust and Monopoly.^{*} A particularly valuable document in these hearings is a report by the Federal Trade Commission on Automobile Warranties: According to this report, warranty costs to the manufacturer were about \$50/car to \$60/car in 1966 when a two year or 24,000 mile warranty coverage was offered. Warranty costs increased by about \$41 to \$51 in 1967 when the manufacturer also included a 5 year/50,000 mile power train guarantee. Based on prices of automobiles in 1966 and 1967, warranty costs represented approximately 2 percent of automobile sales revenue in 1966 and about 3 to 4 percent in 1967.

The percentage values in Table A-8 are lower than percentage estimates for 1976 automobiles presented in Table A-9. These later values are based on 1976 warranty cost data recently published in the trade press based on a study by an independent extended service contract firm, and the average 1976 wholesale

^{*} Federal Trade Commission, "Report on Automobile Warranties," File No. 662 3051, as published in "Automotive Repair Industry," Hearings Before the Subcommittee on Antitrust and Monopoly of the Committee on the Judiciary, U.S. Senate, 91st Congress, Second Session Pursuant S. Res 60 Part 5, Appendix.

TABLE A-8. ESTIMATION OF WARRANTY COSTS.

	<u>1973</u>	<u>1974</u>
	<u>(10⁶\$)</u>	<u>(10⁶\$)</u>
WARRANTY SERVICE (1)	725	709
WARRANTY PARTS (1)	<u>563</u>	<u>570</u>
TOTAL WARRANTY SALES		
BY FRANCHISED DEALERS (1)	1288	1279
U.S. FACTORY SALES		
PASSENGER CARS AND TRUCKS (2)	35784.1	31816.2
LESS EXPORTS (2)	<u>2656.4</u>	<u>3725.2</u>
U.S. FACTORY SALES -		
DOMESTIC USE	33127.7	28091.0
ESTIMATE OF WHOLESALE VALUE OF		
EQUIPPED CARS AND TRUCKS (3)	41410	35390
IMPORTS, CARS AND TRUCKS (2)	<u>6996</u>	<u>8190</u>
TOTAL VEHICLE SALES, WHOLESALE	48406	43585
WARRANTY % VEHICLE SALES	2.7	2.9

SOURCES:

- 1) Franchised New Car and Truck Dealer Facts - 1975, National Automobile Dealers Association, Washington, D.C.
- 2) MVMA, Motor Vehicles Facts and Figures 176
- 3) Assumes a ratio of 1.25x for relative price of equipped vehicle to vehicle with standard options.

price of Automobiles manufactured by each of the major U.S. automobile manufacturers.

For purposes of the price estimate, warranty costs were assumed to be 3 percent of sales.

TABLE A-9. ESTIMATE OF 1976 WARRANTY COSTS

<u>MANUFACTURER</u>	<u>AVERAGE WHOLESALE PRICE OF 1976 AUTOMOBILES</u> ⁽¹⁾	<u>AVERAGE COST OF WARRANTY CLAIM</u> ⁽²⁾	<u>WARRANTY COSTS AS % VEHICLE SALES</u>
AMC	\$3660	\$172.22	4.7
CHRYSLER	\$4433	\$205.83	4.6
FORD	\$4559	\$173.84	3.8
GMC	\$4576	\$248.05	5.4

SOURCES:

- (1) Council on Wage and Price Stability, Memorandum C1WPS-203, October 27, 1976
- (2) J.J. Bohn, "Warranty Claim Costs Vary Widely," pp. 1 and 38, Automotive News, December 6, 1976.

A-5. SOCIAL SECURITY TAXES

Data on the contributions of U.S. employers to payroll taxes are presented in Table A-10. These data will be used in the subsequent manufacturer-specific sections.

A-6. DISTRIBUTION OF HOURLY LABOR IN AUTOMOTIVE MANUFACTURING

The Bureau of Labor Statistics of the U.S. Department of Labor conducted a wage survey on the earnings of hourly workers in the motor vehicle and parts industries in December 1973.* The survey of motor vehicles manufacturing includes all automotive operations--

*U.S. Dept. of Labor, Bureau of Labor Statistics, Bulletin 1912 "Industry Wage Survey, Motor Vehicles and Parts 1973-1974," (1976).

TABLE A-10. U.S. EMPLOYER CONTRIBUTION TO PAYROLL TAXES

SOCIAL SECURITY CONTRIBUTION BY EMPLOYER, % WAGES	5.85	5.85	5.85	5.20	5.20
CEILING SALARY (\$/YR)	14100	13200	10800	9000	7800
MAXIMUM SOCIAL SECURITY CONTRIBUTION PER EMPLOYEE (\$/YR)	824.85	772.20	631.80	468.00	405.60
DISABILITY CONTRIBUTION BY EMPLOYER (% WAGES)	3.20	3.20	3.28	3.20	3.20
CEILING SALARY (\$/YR.)	4200	4200	4200	4200	4200
MAXIMUM DISABILITY CONTRI- BUTION BY EMPLOYER (\$/YR)	134.40	134.40	137.70	137.40	134.40
MAXIMUM SOCIAL SECURITY AND DISABILITY CONTRIBUTION BY EMPLOYER (\$/YR)	959.25	906.60	769.56	602.40	540.00

SOURCE: Statistical Abstract of the United States, 1975

including motor vehicle parts manufacturing--of the four major passenger car manufacturers. The survey excludes the truck division of one firm (x), and the steel and glass operations (if any) of all four companies. Plants engaged in producing tractors and industrial engines, all parts depots, and other separate auxiliary units such as central offices are excluded.

In December 1973, 611,428 production and related workers were employed in the plants covered by the survey.

A number of occupations were selected for separate study. The jobs selected were representative of the various activities performed by production workers in motor vehicle manufacturing. The occupations selected accounted for about 420,000 workers in December 1970--nearly seven-tenths of the industry's work force.

In these studies, the numbers, functions, and hourly wages of different classes of employees were specified in the study. These data were used to determine the fraction of the hourly payroll that could be assigned to major groups of interest for cost estimation purposes. These major groups were:

- 1) Production Employees
 - a. Direct
 - b. Indirect (Material Movement, Plant Clerical)
- 2) Maintenance
- 3) Overhead (Tool Room)

As shown in Table A-11, for the U.S. as a whole, approximately 80 percent of hourly payroll in automotive manufacturing is related to production operations; maintenance labor represents about 13 percent of the payroll, with the manufacture of special tooling representing about 7 percent.

There are geographical differences in the distribution of the hourly payroll. Operations in the South and West are fairly different from the rest of the U.S. In these areas, maintenance and tool room operations consume a much smaller fraction of the payroll than in the other parts of the country. The wage distribution obtained thus reflects the fact that the assembly of automobiles is the major operation in these parts of the country.

TABLE A-11. FUNCTIONAL REPARTITION OF HOURLY PAYROLL OF THE FOUR MAJOR U.S. AUTOMOTIVE MANUFACTURERS BY GEOGRAPHICAL REGION

<u>REGION</u>	<u>MAINTENANCE</u>	<u>TOOL</u>	<u>MATERIAL</u>	<u>DIRECT</u>	<u>TOTAL</u>
	<u>(INCLUDING</u>	<u>ROOM</u>	<u>MOVEMENT AND</u>	<u>PRODUCTION</u>	
	<u>JANITORIAL)</u>		<u>PLANT CLERICAL</u>	<u>LABOR</u>	
<u>PERCENT</u>					
U.S. TOTAL	13.1	7.4	10.2	69.3	100.0
MICHIGAN	13.2	8.1	11.3	67.5	100.0
NORTH CENTRAL (EXCEPT MICHIGAN)	14.0	7.9	9.6	68.5	100.0
S. EAST	14.3	7.4	8.8	69.5	100.0
SOUTH	8.8	2.0	8.7	80.4	100.0
WEST	9.5	1.9	6.9	81.7	100.0

REGIONS:

NORTHEAST: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

SOUTH: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

WEST: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

NORTH CENTRAL: Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, (Except Michigan) North Dakota, Ohio, South Dakota, and Wisconsin

Based on the above data, the payroll of production employees is assumed to be equal to 80 percent of the hourly payroll assigned to automobile and light truck manufacturing for each of the four major manufacturers.

A-7. EXCISE TAXES

Excise taxes are assumed to be equal to \$12.50 per automobile or light truck sold. These excise taxes represent an average value of \$2.50 per tire associated with each vehicle. With a spare, there are five tires which are taxed per vehicle.

APPENDIX B
SOURCES AND DERIVATION OF DATA

B-1 AMERICAN MOTORS CORPORATION, DERIVATION OF DATA

1. CORPORATE SALES: Obtained from company Annual Report (A.R.) or from company's form 10K Annual Report filled with the Securities Exchange Commission (10K form).
2. CORPORATE PRETAX EARNINGS: Obtained from A.R. or 10K form.
3. AUTOMOTIVE SALES - WORLDWIDE: Obtained from 10K form as earnings (losses) before taxes on income for general automotive operations.
4. AUTOMOTIVE PRETAX EARNINGS - WORLDWIDE: Obtained from 10K form as earnings (losses) before taxes for general automotive operations.
5. AUTOMOBILE AND LIGHT TRUCK SALES: The business of the general automotive division consists of the sales of:
 1. Automobiles and light trucks (G.V.W. < 6000 lbs).
 2. Parts for the above.

It does not include the manufacture and sale of heavier vehicles which are principally manufactured by the AM General Corp. AM General Corp. also manufactures some special government vehicles which have a G.V.W. of less than 6000 lbs. The latter are not included in the present calculations.

5A) Revenue from U.S. Sales of Automobiles and Light Trucks: Obtained by subtracting the revenue from U.S. sales of parts from the sales revenue from U.S. automotive products.

5B) Automotive Parts Revenue: Revenue from U.S. sales of automotive parts is assumed to be 10 percent of revenue from U.S. sales of automotive products.

6. AUTOMOBILE AND LIGHT TRUCK PRETAX EARNINGS:

6A) Pretax Earnings Due to the U.S. Sales of Automobiles and Light Trucks: Obtained by subtracting pretax earnings due to the sale of automotive parts from the pretax earnings from general automotive operations.

6B) Automotive Parts Pretax Earnings: The pretax earnings assigned to automotive parts are estimated to be equal to 7 percent of the sales revenue of automotive parts.

7. AUTOMOBILE AND LIGHT TRUCKS TOTAL COSTS: The total costs associated with the manufacture and sale of automobiles and light trucks in the U.S. are equal to the sales revenue less the earnings before taxes assigned to this vehicle group. The total costs are further broken down into a non-variable cost component and a variable cost component, as further outlined below.

8. NON-VARIABLE COSTS - U.S. AUTO AND LIGHT TRUCKS:

8A) Non-Variable Cost Breakdown: The following non-variable cost categories were identified from the income statement presented in the Annual Report and the 10K form, and from Note N - Supplementary Income Statement Information, presented in the 10K form:

- a) Depreciation of Plant, Property and Equipment
- b) Amortization of Special Tools
- c) Research and Development Costs
- d) Selling Costs and General Administrative Expenses
- e) Interest
- f) State and Local Property Taxes
- g) Pension and Retirement - Salaried Employees

8B) Non-Variable Costs (Other Than Pension and Retirement - Salaried Employees): For the first six categories of non-variable costs listed above, the value assigned to automobile and light truck production and sales is obtained by sales weighting: i.e., multiplying the corporate value published in the Operating Statement or notes in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales averaged over five years.

8C) Non-Variable Costs: Pension and Retirement: Salaried Employees: The assigned costs of pensions for salaried employees are estimated by multiplying the corporate pension payments (given in the A.R. or 10K form) by the ratio of estimated salaried payroll to the estimated total corporate payroll. The estimated corporate payroll is obtained by dividing corporate payments for

employee wages and benefits by 1.20 to account for the cost of pensions, payroll taxes and insurance. Salaried payroll is obtained by subtracting the hourly payroll from the corporate payroll. The hourly payroll is obtained by multiplying the number of hourly employees (obtained from the 10K form) by the average hourly wage for employees in the motor vehicles and equipment manufacturing industry (SIC 371) by an estimated number of hours worked per year. The hourly wage figures, which were obtained from MVMA, Motor Vehicles Facts and Figures, '76, are based on data compiled by the U.S. Bureau of Labor Statistics. These figures were used since company specific numbers were not available. With the exception of 1974, an average work year of 2000 hours is assumed. For 1974, when the company experienced a strike, an average work year of 1850 hours is assumed.

The assigned costs of pensions for salaried employees for automobile and light truck production are estimated by multiplying pensions cost for all salaried employees by the ratio of sales of automobiles and light trucks to corporate sales (5 year average).

9. VARIABLE COSTS - U.S. AUTOMOBILE AND LIGHT TRUCKS:

9A) Variable Cost Breakdown: The Following Variable Cost Categories Are Identified:

- a) Maintenance and Repairs
- b) Production Labor - Without Benefits
- c) Insurance Benefits - Production Employees
- d) Pension and Retirement - Production Employees
- e) Payroll Taxes - Production Employees
- f) Warranty Cost
- g) Excise Taxes
- h) Purchase Production Materials and Components
- i) Utilities

9B) Maintenance and Repairs: Maintenance and repairs costs assigned to U.S. automobiles and light truck production are estimated by multiplying corporate maintenance and repair costs identified in Note N of the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales.

9C) Production Labor and Benefits: The sum of the payroll, benefits, and tax payments are the total cost of hourly labor for automobile and light truck production. The total cost of production hourly labor is assumed to be 80 percent of this value, as discussed in Appendix A section A6.

The payroll associated with automobile and light truck production is estimated by multiplying 0.8 times the hourly payroll (as discussed in paragraph 8C) by the ratio of automobile and light truck sales to corporate sales.

Payroll tax contributions for automobile and light truck production labor are estimated by multiplying the employer's payroll tax contribution per employee (as shown in Appendix A section A5.) times the average number of hourly workers in the company's employ, times the ratio of automobile and light truck sales to corporate sales, times 80 percent.

Pension contributions to automobile and light truck production workers are obtained by multiplying corporate pension payments by the ratio of automobile and light truck production worker payroll (with benefits) to corporate costs of wages and benefits.

9D) Warranty Costs: Warranty costs are estimated to be 3 percent of automobile and light truck sales as further discussed in Appendix A section A4.

9E) Excise Taxes: Excise taxes are taken at \$12.50/vehicle.

9F) Purchased Production Materials and Components, and Utilities: The sum of the cost of purchased materials and components, and energy, is the remainder after all other costs identified are subtracted from total costs.

Cost of Production Materials, Components and Utilities =
Total Costs - Fixed Costs - Other Variable Costs

Based on fuel and energy consumption by the automotive industry, as reported in the 1972 Census of Manufacture for SCI Group 371, energy costs are assumed to be 0.5 percent of this total value, with production materials being the remainder (99.5 percent).

B-2 CHRYSLER CORPORATION, SOURCES AND DERIVATION OF DATA

1. CORPORATE SALES: Obtained from company Annual Stockholders' Report (A.R.) or from company's form 10K Annual Report filed with the Securities Exchange Commission (10K form).
2. CORPORATE PRETAX EARNINGS: Obtained from A.R. or 10K form.
3. WORLDWIDE AUTOMOTIVE EARNINGS: Obtained by subtracting non-automotive sales, as published in the Annual Report, from corporate sales. Non-automotive sales are corrected for the divestment of the Airtemp Division.
4. WORLDWIDE AUTOMOTIVE EARNINGS - PRETAX: Obtained by subtracting non-automotive pretax earnings from corporate pretax earnings. Based on a statement published in the 1975 10K form as to the "modest" profitability of the non-automotive business, a pretax profit of 3 percent of sales is assumed for these operations.
5. AUTOMOTIVE SALES, U.S.:

5A) Automotive Sales, U.S. and Canada: Sales from U.S. and Canadian automotive operations are obtained by subtracting from total corporate sales the sum of sales from operations outside the U.S. and Canada (obtained from the 10K form) and the sales from non-automotive operations, obtained from the Annual Report. Non-automotive sales are corrected for the divestment of the Airtemp Division. According to the 10K form, non-automotive operations were limited to the U.S. and Canada.

5B) Corporate Sales, U.S.: U.S. corporate sales were obtained by subtracting from total corporate sales, sales from Canadian operations (given in the 10K form) and sales from operations outside the U.S. and Canada.

5C) Canadian Non-Automotive Sales: It is assumed that all defense work performed by Chrysler Corporation was performed in the U.S. By subtracting the sales volume of the defense business of the company (as listed in the Annual Report) one obtains the non-automotive, non-defense sales of the corporation in the U.S. and Canada. Canadian sales in this category are estimated by multiplying this number by the ratio of Canadian corporate sales to the total corporate sales in the U.S. and Canada.

5D) Canadian Automotive Sales: Canadian automotive sales are obtained by subtracting Canadian non-automotive sales from corporate Canadian sales.

5E) U.S. Automotive Sales: U.S. automotive sales are obtained by subtracting Canadian automotive sales from U.S. and Canadian automotive sales.

6. AUTOMOTIVE PRETAX EARNINGS, U.S.:

6A) Contribution of Operations Outside U.S. and Canada to Pretax Earnings: The equivalent contribution to pretax earnings of foreign operation is obtained by multiplying the ratio of net earnings (after tax) outside U.S. and Canada to corporate net earnings (after tax) of continuing operations, by the value of the corporate pretax earnings.

6B) Pretax Earnings Due to U.S. and Canada Automotive Operations: Obtained by subtracting from corporate pretax earnings the sum of the equivalent contribution to pretax earnings from foreign operations and the pretax contribution to earnings from non-automotive operations.

6C) Pretax Earnings Due to U.S. Automotive Operations: Obtained by multiplying the pretax earnings due to U.S. and Canada automotive operations by the ratio of sales from U.S. automotive operations to sales from U.S. and Canada automotive operations.

7. AUTOMOBILE AND LIGHT TRUCK SALES: The automotive business is considered to consist of three subgroups:

- 1) Automobiles and Light Trucks (G.V.W. < 6000 lbs).
- 2) Heavy Trucks with G.V.W. > 600 lbs.
- 3) Parts for Automobiles and Trucks as discussed in Appendix A sections A2. and A3.

8. AUTOMOBILE AND LIGHT TRUCK PRETAX EARNINGS: Obtained by subtracting pretax earnings due to the sales of automotive parts and the sale of heavy trucks from the pretax earnings assigned to U.S. operations, automotive products, as discussed in Appendix A sections A-2 and A-3.

9. INCENTIVE PROGRAM: The contributions to the incentive program are treated as contributions to pretax earnings rather than as fixed costs. This contribution disappears when the corporation does not show a suitable profit. The contribution of the corporate incentive program payments, as reported in the Annual Report or the 10K form, assigned to the sale of automobiles and light trucks, is in proportion to the ratio of pretax earnings for automobiles and light trucks, to corporate pretax earnings.

10. AUTOMOBILE AND LIGHT TRUCKS TOTAL COSTS (WITHOUT INCENTIVE PROGRAM): The total costs associated with the manufacture and sale of automobiles and light trucks in the U.S. are equal to the sales revenue less the sum of profits and incentive program payments, assigned to this vehicle group. The total costs are further broken down into a non-variable cost component and a variable cost component, as further outlined below.

11. NON-VARIABLE COSTS - U.S. AUTO AND LIGHT TRUCKS:

11A) Non-Variable Cost Breakdown: The following non-variable cost categories are identified from the income statement presented in the annual report and the 10K form, and from Schedule XVI - Supplementary Income Statement Information, presented in the 10K form:

- a) Depreciation of Plant, Property and Equipment
- b) Amortization of Special Tools
- c) Research and Development Costs
- d) Selling Costs and General Administrative Expenses
- e) Interest
- f) State and Local Property Taxes
- g) Pension and Retirement - Salaried Employees

11B) Non-Variable Costs (Other Than Pension and Retirement - Salaried Employees): For the first five categories of non-variable costs listed above, the value assigned to U.S. automobile and light truck production and sales is obtained by sales weighting: i.e., multiplying the corporate value published in the Operating Statement or notes in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales (5 year average).

11C) Non-Variable Costs: State and Local Property Taxes:

All taxes (other than United States and other country taxes on income) paid by Chrysler in the U.S. are estimated by multiplying the value for these taxes paid by Chrysler Corp. on a worldwide basis by the ratio of U.S. sales to worldwide sales. The contribution to payroll taxes by Chrysler in the U.S. is then deducted from this value to obtain an estimate of state and property taxes paid by Chrysler in the U.S. Payroll taxes paid by Chrysler in the U.S. are estimated to be the product of the average number of U.S. employees by the maximum employer contribution to social security and disability as required by law. State and local property taxes assigned to U.S. automobile and light truck production are then estimated by multiplying the estimated state and local property taxes paid by Chrysler in the U.S. by the ratio of U.S. automobile and light truck sales to U.S. sales (5 year average).

11D) Non-Variable Costs: Pension and Retirement: The assigned cost of pensions of all U.S. salaried employees is estimated by multiplying corporate pension payments by the ratio of U.S. salaried employees estimated payroll to the corporate worldwide payroll (as given in the Annual Report). The U.S. salaried employees estimated payroll is obtained as the difference between the U.S. payroll (as given in the corporate Annual Report) and the estimated payroll for hourly employees. The estimated payroll for hourly employees is obtained by multiplying the average number of U.S. hourly employees by the average weekly hours worked by average total hourly labor costs per hour worked - including employee benefits, by the number of weeks in a year (52), by the ratio of hourly labor costs without benefits to hourly labor costs with benefits. The first three values are all published yearly in the Annual Report. Given the unionized structure of the U.S. auto industry, it is assumed that the ratio of hourly costs without benefits to hourly costs with benefits would not vary significantly from company to company. The ratio for Ford Motor Co., which can be obtained from data published in the Ford Annual Report, is assumed to be valid for Chrysler.

The assigned cost of pensions for salaried employees associated with U.S. auto and light truck manufacture is estimated by multiplying pension payments for U.S. salaried employees by the ratio of U.S. automobile and light truck sales to total U.S. sales (5 year average).

12. VARIABLE COSTS - U.S. AUTOMOBILE AND LIGHT TRUCKS:

12A) Variable Cost Breakdown: The following variable cost categories are identified:

- a) Maintenance and Repairs
- b) Production Labor - With Benefits
- c) Warranty Costs
- d) Excise Taxes
- e) Purchased Production Materials and Components
- f) Energy Costs

12B) Maintenance and Repairs: Maintenance and repairs costs assigned to U.S. automobiles and light truck production are estimated by multiplying corporate maintenance and repair costs identified in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales.

12C) Production Labor (With Benefits): For any given year, the average number of U.S. employees, the average number of hourly workers employed in the U.S., the annual U.S. payroll, and U.S. hourly wages with benefits and the average weekly hours worked by hourly employees are given in the Annual Report of the company.

The number of hourly employees associated with U.S. automobile and light truck production is estimated to be 80 percent of the number of hourly workers employed in the U.S. multiplied by the ratio of U.S. automobile and light truck sales to corporate U.S. sales.

The cost of labor for U.S. automobile and light truck production is estimated to be equal to the product of the number hourly employees assigned to this operation by the average total hourly labor costs per hour worked including employee benefits (as published in the corporate Annual Report) by the number of hours

worked per week by hourly employees.

12D) Warranty Costs: Warranty costs are estimated to be 3 percent of U.S. automobile and light truck sales as further discussed in Appendix A section A-4.

12-E) Excise Taxes: Excise taxes are assumed to be \$12.50 per vehicle.

12F) Purchased Production Materials and Components, and Utilities: The sum of the cost of purchased materials and components, and utilities, is the remainder after all other costs identified are subtracted from total costs.

Cost of Production Materials, Components and Energy =
Total Costs - Fixed Costs - Other Variable Costs

Based on fuel and energy consumption by the automotive industry, as reported in the 1972 Census of Manufacture for SIC Group 371, energy costs are assumed to be 0.5 percent of this total value, with production materials being the remainder (99.5 percent).

B-3 FORD MOTOR COMPANY, SOURCES AND DERIVATION OF DATA

1. CORPORATE SALES: Obtained from company Annual Stockholders' Report (A.R.) or from company's form 10K Annual Report (10K form) filed with the Securities Exchange Commission.
2. CORPORATE PRETAX EARNINGS: Obtained from A.R. or 10K form.
3. AUTOMOTIVE SALES: Sales data for automotive operations on a worldwide basis are reported in the 10K form.
4. AUTOMOTIVE PRETAX EARNINGS: Income before income taxes for worldwide automotive operations are reported in the 10K form.
5. AUTOMOTIVE SALES, U.S.: Sales derived from U.S. and Canadian automotive operations are estimated by subtracting sales from automobile operations outside the U.S. and Canada from sales derived from worldwide automotive operations. Canadian automotive sales are then factored out to obtain a U.S. automotive sales estimate.

5A) ESTIMATE OF FOREIGN AUTOMOTIVE SALES: Sales from automotive operations on a worldwide basis and sales from foreign operations outside the U.S. and Canada are both reported in the 10K form. The difference between these two numbers is equal to the sales derived from automotive operations in the U.S. and Canada minus the sales derived from the Company's foreign non-automotive operations.

$$\begin{array}{lcl} \text{Automotive Sales, Worldwide} & = & \text{Automotive Sales (U.S. + Canada)} \\ & & + \text{Automotive Sales (foreign)} \\ \text{Foreign Sales} & = & \text{Non-Automotive Sales (foreign) +} \\ & & \text{Automotive Sales (foreign)} \\ \hline \text{Automotive Sales Worldwide} - \text{Foreign Sales} & = & \text{Automotive Sales} \\ & & \text{(U.S. + Canada) - Non-Automotive} \\ & & \text{Sales (foreign)} \end{array}$$

Non-automotive operations include finance and insurance activities, tractor operations, and the non-automotive portions of Aeroneutronic Ford and its consolidated subsidiaries, and of the steel and glass operations. Finance and insurance operations are unconsolidated subsidiaries, the operations of which are reported separately. These sales are not included in the non-automotive sales from consolidated subsidiaries. The manufacture of

tractors overseas represents Ford's principal foreign non-automotive activity. Based on the overseas tractor production figures published in the annual report and the probable value of these tractors, it is estimated that foreign non-automotive operations represent 25 percent of all non-automotive operations; this is equivalent to 2 to 3 percent of consolidated corporate sales. In comparison, the resulting estimate of sales from U.S. and Canadian automotive operations represents from about 60 to 70 percent of corporate sales. Thus, even a large error in the estimated sales from foreign non-automotive operations does not introduce a large error in the U.S. and Canadian automotive sales estimate.

5B) ESTIMATE OF U.S. AUTOMOTIVE SALES: U.S. automotive sales are disaggregated from the sum of U.S. and Canadian automotive sales on the basis of the automobile and truck production figures published for the two countries in the corporate annual report. The relative value of automobile and truck production is estimated for each country according to the method described in Appendix A section A2. It is assumed that the distribution of trucks by gvw class in Canada is the same as that in the U.S. U.S. automotive sales estimate is obtained by multiplying the value of automotive sales for U.S. and Canada by the ratio of the relative value of automobiles and trucks manufactured in the U.S. to the relative value of automobiles and trucks manufactured in the U.S. and Canada.

6. AUTOMOTIVE PRETAX EARNINGS, U.S.: The same methodology is used to disaggregate an estimate of pretax earnings from U.S. automotive operations as was used in estimating sales from U.S. automotive operations. There are variations in the details, however.

6A) INCOME FROM CONSOLIDATED NON-AUTOMOTIVE OPERATIONS: Income from consolidated non-automotive operations is obtained by subtracting the contribution of Ford Motor Credit Company and its consolidated subsidiaries from non-automotive income before income taxes. The above data are obtained from the 10K form.

6B) FOREIGN INCOME: The contributions to net income by operations outside the U.S. and Canada are given in the 10K form. An equivalent pretax income due to these operations is obtained by multiplying this value by the ratio of corporate pretax income to corporate net income.

6C) PRETAX INCOME FROM U.S. AND CANADA AUTOMOTIVE OPERATIONS: The pretax income for U.S. and Canada automotive operations is estimated to be equal to the pretax income automotive operations minus the equivalent pretax income derived from foreign operations, plus 25 percent of the pretax income of consolidated non-automotive operations (see section 5A for more details).

6D) PRETAX INCOME FROM U.S. AUTOMOTIVE OPERATIONS: Pretax income from U.S. automotive operations is estimated by multiplying the pretax income estimate for U.S. and Canada automotive operations by the ratio of sales from U.S. automotive operations to sales from U.S. and Canada automotive operations.

7. AUTOMOBILE AND LIGHT TRUCK SALES: As discussed in more detail in Appendix A, the automotive business is considered to consist of three subgroups:

- 1) Automobiles and Light Trucks (G.V.W. <6000 lbs).
- 2) Heavy Trucks with G.V.W. > 6000 lbs.
- 3) Parts for Automobiles and Trucks.

Revenue from U.S. sales of automobiles and light trucks is obtained by subtracting the revenue from U.S. sales of parts and heavy trucks from the sales revenue from U.S. automotive products, as discussed in Appendix A sections A-2 and A-3.

8. AUTOMOBILE AND LIGHT TRUCK PRETAX EARNINGS: Pretax earnings due to the U.S. sales of automobiles and light trucks are obtained by subtracting pretax earnings due to the sale of automotive parts and the sale of heavy trucks from the pretax discussed in Appendix A sections A-2 and A-3.

9. INCENTIVE PROGRAM: The contributions to the incentive program are treated as a contribution to pretax earnings rather than as a fixed cost. This contribution disappears when the corporation does not show a suitable profit. The contribution of the corporate incentive program payments, as reported in the annual report or the 10K form, assigned to the sale of automobiles and light trucks is in proportion to the ratio of pretax earnings for automobiles and light trucks, to corporate pretax earnings.

10. AUTOMOBILE AND LIGHT TRUCKS TOTAL COSTS (WITHOUT INCENTIVE PROGRAM): The total costs associated with the manufacture and sale of automobiles and light trucks in the U.S. are equal to the sales revenue less the sum of profits and incentive program payments, assigned to this vehicle group. The total costs are further broken down into a non-variable cost component and a variable cost component, as further outlined below.

11. NON-VARIABLE COSTS - U.S. AUTO AND LIGHT TRUCKS:

11A) NON-VARIABLE COST BREAKDOWN: The following non-variable cost categories are identified from the income statement presented in the annual report and the 10K form, and from Schedule XVI - Supplementary Income Statement Information, presented in the 10K form:

- a) Depreciation of Plant, Property and Equipment
- b) Amortization of Special Tools
- c) Research and Development Costs
- d) Selling Costs and General Administrative Expenses
- e) Interest
- f) State and Local Property Taxes
- g) Pension and Retirement - Salaried Employees

11B) NON-VARIABLE COSTS (OTHER THAN PENSION AND RETIREMENT - SALARIED EMPLOYEES): For the first six categories of non-variable costs listed above, the value assigned to U.S. automobile and light truck production and sales is obtained by sales weighing: i.e., multiplying the corporate value published in the Operating

Statement or notes in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales (5 year average).

11C) NON-VARIABLE COSTS: PENSION AND RETIREMENT - SALARIED EMPLOYEES: The assigned cost of pensions for all employees associated with U.S. auto and light truck manufacture is estimated by multiplying corporate pension payments by the ratio of U.S. automobile and light truck sales to corporate sales.* The cost of pensions and retirement for hourly workers is then calculated as further discussed below in the variable cost section. The cost of pension and retirement of salaried employees is obtained as the difference of these two numbers.

12. VARIABLE COSTS - U.S. AUTOMOBILE AND LIGHT TRUCKS:

12A) VARIABLE COST BREAKDOWN: THE FOLLOWING VARIABLE COST CATEGORIES ARE IDENTIFIED:

- a) Maintenance and Repairs
- b) Production Labor - With Benefits
- c) Warranty Costs
- d) Excise Taxes
- e) Purchased Production Materials and Components
- f) Energy

12B) MAINTENANCE AND REPAIRS: Maintenance and repairs costs assigned to U.S. automobiles and light truck production are estimated by multiplying corporate maintenance and repair costs identified in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales.

12C) PRODUCTION LABOR (WITH BENEFITS): For any given year, the average number of U.S. employees, the average number of hourly workers employed in the U.S., the annual U.S. payroll, and U.S., hourly wages with and without benefits are given in the annual report for the company. In addition, the company also reports employment and payroll, pensions and payroll taxes on a worldwide basis.

* 5 year average.

The number of hourly employees associated with U.S. automobile and light truck production is estimated as being 80 percent of the number of hourly workers employed in the U.S. multiplied by the ratio of U.S. automobile and light truck sales to corporate U.S. sales.

The cost of labor for U.S. automobile and light truck production is estimated to be equal to the product of the number hourly employees assigned to this operation by the average total hourly labor costs per hour worked including employee benefits (as published in the corporate annual report) by the number of hours worked by hourly employees. For lack of more specific data, a value of 2000 hrs/year is assumed.

The estimated costs of pensions for the U.S. automobile and light truck hourly work force are estimated by multiplying the ratio of corporate pension payments to worldwide payroll by the estimated payroll for the U.S. automobile and light truck work force. This payroll is estimated as the product of the number of hourly employees assigned to the U.S. automobile and light truck manufacture by the average hourly labor costs per hour without fringe benefits (as published in the corporate annual report) by the assumed value of 2000 hrs/year for a work year. This calculated cost of labor with benefits, is used to estimate pension costs for salaried employees assigned to U.S. automobile and light truck production.

12D) WARRANTY COSTS: Warranty costs are estimated to be 2 percent of U.S. automobile and light truck sales as further discussed in Appendix A section A-4.

12E) Excise Taxes: Excise taxes are assumed to be \$12.50 per vehicle.

12F) PURCHASED PRODUCTION MATERIALS AND COMPONENTS, AND ENERGY: The sum of the cost of purchased materials and components, and utilities, is the remainder after all other costs identified are subtracted from total costs.

Cost of Production Materials, Components and Energy = Total

Costs - Fixed Costs - Other Variable Costs

Based on fuel and energy consumption by the automotive industry, as reported in the 1972 Census of Manufacture for SIC Group 371, energy costs are assumed to be 0.5 percent of this total value with production materials being the remainder (99.5 percent).

B-4. GENERAL MOTORS CORPORATION, SOURCES AND DERIVATION OF DATA

1. CORPORATE SALES: Obtained from company Annual Stockholders' Report (A.R.) or from company's form 10K Annual Report filed with the Securities Exchange Commission (10K form).
2. CORPORATE PRETAX EARNINGS: Obtained from A.R. or 10K form.
3. AUTOMOTIVE SALES - U.S.: Sales data for U.S. operations, automotive products, as reported in 10K form, after accounting for inter-company sales.
4. AUTOMOTIVE PRETAX EARNINGS, U.S.: Obtained by multiplying percentage of net corporate income due to U.S. operations and automotive products as reported in 10K form, by consolidated corporate pretax earnings. This assumes that the proportional contribution of this business line to corporate pretax earnings is the same as its proportional contribution to corporate net earnings.
5. AUTOMOBILE AND LIGHT TRUCK SALES: The automotive business is considered to consist of three subgroups:
 - 1) Automobiles and Light Trucks (G.V.W. < 6000 lbs.)
 - 2) Heavy Trucks with G.V.W. > 6000 lbs.
 - 3) Parts for Automobiles and Trucks.

Revenue from U.S. sales of automobiles and light trucks is obtained by subtracting the revenue from U.S. sales of parts and heavy trucks from the sales revenue from U.S. automotive products, as discussed in Appendix A sections A-2 and A-3.

6. AUTOMOBILE AND LIGHT TRUCK PRETAX EARNINGS:

Pretax earnings due to the U.S. sales of automobiles and light trucks are obtained by subtracting pretax earnings due to the sale of automotive parts and the sale of heavy trucks from the

pretax earnings assigned to U.S. operations, automotive products, as discussed in Appendix A sections A-2 and A-3.

7. INCENTIVE PROGRAM: The contributions to the incentive program are treated as a contribution to pretax earnings rather than as a fixed cost. This contribution disappears when the corporation does not show a suitable profit. The contribution of the corporate incentive program payments, as reported in the annual report or the 10K form, assigned to the sale of automobiles and light trucks, is in proportion to the ratio of pretax earnings for automobiles and light trucks, to corporate pretax earnings.

8. AUTOMOBILE AND LIGHT TRUCKS TOTAL COSTS (WITHOUT INCENTIVE PROGRAM): The total costs associated with the manufacture and sale of automobiles and light trucks in the U.S. are equal to the sales revenue less the sum of profits and incentive program payments, assigned to this vehicle group. The total costs are further broken down into a non-variable cost component and a variable cost component, as further outlined below.

9. NON-VARIABLE COSTS - U.S. AUTO AND LIGHT TRUCKS:

9A) Non-Variable Cost Breakdown: The following non-variable cost categories are identified from the income statement presented in the annual report and the 10K form, and from Schedule XVI - Supplementary Income Statement Information, presented in the 10K form:

- a) Depreciation of Plant Property and Equipment
- b) Amortization of Special Tools
- c) Research and Development Costs
- d) Selling Costs and General Administrative Expenses
- e) Interest
- f) State and Local Property Taxes
- g) Pension and Retirement - Salaried Employees

9B) Non-Variable Costs (Other Than Payroll Taxes - Salaried Employees and Pension and Retirement - Salaried Employees):

For the first six categories of non-variable costs listed above, the value assigned to U.S. automobile and light truck pro-

duction and sales is obtained by sales weighting: i.e., multiplying the corporate value published in the operating statement or notes in the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales (5 year average).

9C) Non-Variable Costs: Pension and Retirement - Salaried Employees:

The assigned cost of pensions for all employees associated with U.S. auto and light truck manufacture is estimated by multiplying corporate pension payments by the ratio of U.S. automobile and light truck sales to corporate sales.* The cost of pensions and retirement for hourly workers is then calculated as further discussed below in the variable cost section. The cost of pension and retirement of salaried employees is obtained from the difference of these two numbers.

10. VARIABLE COSTS - U.S. AUTOMOBILE AND LIGHT TRUCKS

10A) Variable Cost Breakdown: The following variable cost categories are identified:

- a) Maintenance and Repairs
- b) Production Labor - Without Benefits
- c) Insurance Benefits - Production Employees
- d) Pension and Retirement - Production Employees
- e) Payroll Taxes - Production Employees
- f) Excise Taxes
- g) Warranty Costs
- h) Purchased Production Materials and Components
- i) Energy

10B) Maintenance and Repairs: Maintenance and repairs costs assigned to U.S. automobiles and light truck production are estimated by multiplying corporate maintenance and repair costs identified in Schedule XVI of the 10K form by the ratio of U.S. automobile and light truck sales to corporate sales.

10C) Production Labor and Benefits: For any given year, the average number of hourly workers employed in the U.S., the annual

*
5 year average

U.S. hourly payroll, U.S. hourly wages including items such as vacations and holiday pay but excluding benefit plan costs, benefit plan contributions for all U.S. hourly work week (for 1973 and prior years) are given in the annual report of the company. In addition, the company also reports employment and payroll, pensions and payroll taxes on a worldwide basis.

The hourly payroll associated with U.S. automobile and light truck production is estimated by multiplying 80 percent of the U.S. hourly payroll by the ratio of U.S. automobile and light truck sales to corporate U.S. sales. This value includes the cost of production labor, exclusive of maintenance tooling labor, without fringe benefits (other than vacation time) and without payroll tax contributions.

Payroll tax contributions for U.S. automobile and light truck production are estimated by multiplying the employer's payroll tax contribution per employee (as shown in Table A-10) times the average number of hourly workers in the company's employ, times the ratio of U.S. automobile and light truck sales to U.S. corporate sales.

Benefit contributions for all U.S. hourly workers are estimated to be 66 percent of the company's benefit contributions to all U.S. employees. The 1972 Annual Report mentioned the value of fringe benefits to the U.S. hourly employee of General Motors Corp. in 1972, as shown in Table B-1. The breakdown of fringe benefits, as defined by General Motors Corp. was discussed in the 1973 Annual Report, as shown in Table B-2. By multiplying the 1972 contribution per hourly employee (\$2400) by the average number of U.S. hourly employees in 1972 (413,000), one obtains the amount of money contributed by General Motors Corp. to its hourly employees (\$990 million). This is 66 percent of the General Motors Corp. benefits contributions to all its U.S. employees (\$1500 million). It appears more reasonable to consider that the percentage of all benefits paid to hourly employees would remain more constant than other possible estimations (benefits as a constant percent of wages). The cost of benefits for U.S. automobile and light truck hourly

TABLE B-1. VALUE OF FRINGE BENEFITS
TO U.S. GM HOURLY EMPLOYEE (1972).

		<u>% GROSS</u>
		<u>EARNINGS</u>
GROSS EARNINGS BEFORE TAXES (1)	\$12,500	
PAYROLL TAXES AND BENEFIT PROGRAMS (1)	3,000	24%
SOCIAL SECURITY AND DISABILITY CONTRIBUTIONS (2)	<u>602</u>	5%
VALUE OF BENEFITS PROGRAMS	2,400	19%

*INCLUDES INSURANCE PREMIUMS, PENSION CONTRIBUTIONS AND SOCIAL SECURITY TAXES.

(1) SOURCE: GENERAL MOTORS CORP. ANNUAL REPORT, 1972.

(2) SOURCE: STATISTICAL ABSTRACT OF THE UNITED STATES.

TABLE B-2. GM CONTRIBUTION TO U.S. EMPLOYEE BENEFITS (1973)

<u>BENEFIT</u>	<u>AMOUNT (\$ MILLION)</u>	<u>% TOTAL</u>
INSURANCE, MEDICAL	870	51
PENSION	625	37
LAYOFF PROTECTION	110	7
PROFIT SHARING PROGRAM		
(SALARIED EMPLOYEES)	69	4
SUGGESTIONS	<u>15</u>	<u>1</u>
TOTAL	1689	100

SOURCE: GENERAL MOTORS CORPORATION ANNUAL REPORT, 1973

employees is obtained by multiplying by the ratio of U.S. sales of automobiles and light trucks to total U.S. sales of the corporation.

The sum of the payroll, benefits, and payroll tax payments are the total cost of hourly labor for U.S. automobile and light truck production workers.

Within the calculation of benefit contributions, the pension contribution to U.S. automobile and light truck workers are obtained by multiplying the corporate pension payment by the ratio of U.S. automobile and light truck production worker payroll to corporate worldwide payroll. This calculation assumes that the pension contribution is a function of the employees wage or salary. Insurance and other contributions to U.S. automobile and light truck production workers are then the difference between the total benefits payment and the pension payments received by this group.

10D) Excise Taxes: Excise taxes assigned to U.S. automobile and light truck production are estimated to be \$12.50/vehicle produced, to account for the excise tax on the five tires on/in the vehicle.

10E) Warranty Costs: Warranty costs are estimated to be 3 percent of U.S. automobile and light truck sales as further discussed in Appendix A section A-4.

10F) Purchased Production Materials and Components, and Energy: The sum of the cost of purchased materials and components, and energy, is the remainder after all other costs identified were subtracted from total costs.

Cost of Production Materials, Components and Energy =
Total Costs - Fixed Costs - Other Variable Costs

Based on fuel and energy consumption by the automotive industry, as reported in the 1972 Census of Manufacture for SIC Group 371, energy costs are assumed to be 0.5 percent of this total value, with production materials being the remainder (99.5 percent).

APPENDIX C
REPORT OF INVENTIONS

No subject inventions were developed under the contract. However a number of novel contributions to the technical literature evolved out of this work:

- a) Prior to this report, no systematic analysis had been performed on the costs and revenues of the four major domestic automotive manufacturers.
- b) An analysis was performed for the first time at three levels of disaggregation to compare Worldwide, North American and U.S. automotive operations for the major manufacturers.
- c) A significant amount of diverse information was assembled and analyzed to form the basis of some general cost estimation procedures for automotive manufacturing operations.

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